COMPARITIVE STUDY BETWEEN POSTOPERATIVE OUTCOMES OF TRANSABDOMINAL PREPERITONEAL REPAIR VS TOTALLY EXTRA PERITONEAL REPAIR FOR INGUINAL HERNIA REPAIR

DISSERTATION SUBMITTED FOR

BRANCH - I M.S (GENERAL SURGERY)

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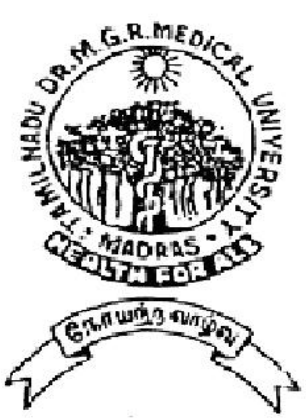

THE TAMILNADU

DR.M.G.R.MEDICAL UNIVERSITY

CHENNAI

CERTIFICATE

This is to certify that the dissertation entitled **"COMPARITIVE STUDY BETWEEN POST OPERATIVE OUTCOMES OF TRANSABDOMINAL PREPERITONEAL REPAIR (TAPP) VS TOTALLY EXTRA PERITONEAL REPAIR (TEP) FOR INGUINAL HERNIA REPAIR"** is the bonafide work of **Dr. K. DILIP KUMAR** in partial fulfillment of the university regulations of the Tamil Nadu Dr. M.G.R. Medical University, Chennai, for M.S (Branch I) General Surgery examination to be held in April 2012.

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DECLARATION

I, **Dr. K. DILIP KUMAR.,** hereby declare that, I carried out this work on **"COMPARITIVE STUDY BETWEEN POST OPERATIVE OUTCOMES OF TRANSABDOMINAL PREPERITONEAL REPAIR (TAPP) VS TOTALLY EXTRA PERITONEAL REPAIR (TEP) FOR INGUINAL HERNIA REPAIR""** at the Department of Surgery, Govt. Rajaji Hospital, Madurai, under the guidance of **Prof. Dr. M. JEBAMANI, M.S.,** Professor of Surgery, during the period of September 2009 to August 2011. I also declare that this bonafide work has not been submitted in part or full by me or any others for any award, degree or diploma to any other University or Board either in India or abroad.

This is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the rules and regulations for the M.S degree examination in General Surgery (Branch I) to be held in April 2012.

Place: Madurai

Date: **(Dr.K. DILIP KUMAR)**

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CONTENTS

INTRODUCTION

A hernia is defined as an area of weakness or complete disruption of the fibromuscular tissues of the bodywall. Structures arising from the cavity contained by the body wall can pass through or herniate, through such a defect. While the definition is straight forward, the terminology is often mispresented. It should be clear that hernia refers to the actual anatomic weakness or defect and hernia contents describe those structures that pass through the defect.

Hernias are among the oldest known afflictions of humankind, and surgical repair of the inguinal hernia is the most common general surgery procedure performed today. Despite the high incidence, the technical aspects of hernia repair continue to evolve.

When the modern techniques for inguinal hernia repair were described in 19^{th} century, recurrence was the problem.

All conventional tissue repairs have a common problem in suture line tension. This tension is the prime cause for tissue or suture disruption causing hernia recurrence.

The advent of synthetic mesh made possible the bridging of large gaps in the tissues without tension, making it possible to cure every hernia, irrespective of its size or shape.

The "Lichtenstein" introduced his concept of "tension - free" repair of inguinal hernias using synthetic polypropylene mesh. The introduction of laproscopic techniques opened a new era in inguinal hernia repair.

Although groin hernia repair is associated with excellent short and large term outcomes, complications of the procedure exist and must be recognized.

AIM AND OBJECTIVES

As there is a scarcity of data directly comparing laparoscopic TAPP and laparoscopic TEP and question remain about their relative merits and risks.

This study aims to compare post operative outcomes of TAPP and TEP directly in order to determine which method is associated with better outcomes.

HISTORY OF HERNIA SURGERY

200 BC	Heliodorus	Described his original method for hernia repair.
200 BC	Galen	Described Anatomy of the abdominal wall
1559	Maupassius	First operation to relieve a strangulated hernia
16th century	Caspar Stromayr	Defined direct and indirect hernias; stressed importance of high dissection of the indirect sac; sanctioned removal of testicle and spermatic cord for indirect hernia
1714-1788	Percivall Pott	Early surgery for congenital hernia
1718-1841	Sir Astley Cooper	Anatomy of the groin, crural and umbilical hernias; cremasteric fascia and the transversalis fascia, In both 1804 and 1807 he published 'The anatomy and surgical treatment of inguinal and congenital hernias' regarded by many at the time as a seminal work in the field.
	Vesalius	Described the inguinal ligament.
1728-1793	John Hunter	Described the process vaginalis and the gubernaculi testis
1742-1812	August Gottlieb Richter	Founder of First German Surgical Journal, Published a work on hernia which was considered best during his period and described Richter's hernia
1759-1816	Hesselbach	Defined iliopubic tract; described importance of the medial triangle of the groin (included the femoral canal) described the "corona mortis"
1780-1883	Jules-Germian Cloquet	Postnatal closure of the processus vaginalis ; made observations of the iliopubic tract
1791-1870	John Gay	Femoral sheath canal
	de Gimbernat	Described lacunar ligament, and its division in the treatment of strangulated femoral hernias.

	Kocher	Twisted and suture-transfixed the peritoneal sac in the lateral muscles through the external ring
1823-1825	Bogros	Bogros space
1844 - 1924	Edoardo Bassini	The father of modern herniorrhaphy, Bassini Technique, Triple layer approximation to the shelving edges of the inguinal ligament.
1858	Anders Adolph Retzius	Retropubic space of Retzius
1868-1935	George Lotheissan	Cooper's ligament repair
1871	Marcy	Publication of original paper on antiseptic herniorrhaphy ("A New Use of Carbolized Catgut Ligature")
1876	Czerny	Described ligating and excising the indirect peritoneal sac through the external ring
	Lucas Cham pionniere	High ligation at deep ring, opened the external oblique aponeurosis to expose the entire inguinal canal.
1920	Cheatle	Internal ring closure

Usher [1960] wrote "we have found that if the mesh is used to bridge the defect instead of as a reinforcement for tissues approximated under stress, factor of tension is eliminated, and recurrence become less likely". Coollier and Griswald [1967] described the routine use of polypropylene mesh in inguinal hernia repairs.

In 1974 Lichtenstein, described a method of using a mesh for reinforcing posterior wall in the repair of both inguinal hernia and femoral hernias.

With the advent of laparoscopy for general surgery, various laparoscopic techniques have been developed for inguinal hernia repair, including the trans abdominal pre-peritoneal repairs, the intra peritoneal onlay mesh repair and the totally extra peritoneal repairs.

Ger and Associates reported first laparoscopic inguinal hernia repair. Schultz et al were the first to report the use of prosthetic material during laparoscopic inguinal hernia repair.

REVIEW OF LITERATURE

Laparoscopic Inguinal Hernia Repair (LIHR) has got comparable results in comparison to tension free open hernia repair (OHR). Many studies have shown that LIHR gives similar results in terms of recurrence as compared with OHR but with the added advantage of less chances of post operative, pain, wound infection and early return to activity

Arvidasson D et al8 compared 5 years recurrence rates of laparoscopic inguinal hernia repair Vs. Shouldice repair of primary inguinal hernia which is considered the gold standard for open non-mesh repair of hernia. The cumulative recurrence rate after 5 years was 6.6% in the TAPP group and 6.7% in the Shouldice group

Wara et al 9 have demonstrated that laparoscopic repair compared favourably with Lichteinstein repair for primary indirect and direct hernias, unilateral and bilateral hernias, and recurrent hernias but was inferior for primary bilateral hernias.

There have been 4 non randomized comparative studies that have compared the 2 techniques i.e. TAPP vs TEP (4,10,-12). The results of these comparative trials have shown that the 2 techniques are comparable with regard to the complications such as vascular and visceral injury. However, the port site recurrence was shown to be higher in the TAPP

compared with TEP technique. The operating time and the cost of the procedure were not compared in any of the trials.

In a comparative trial of 491 consecutive herniorraphies by Kald et al12, TAPP was compared with TEP. Hernia recurrence was shown to be higher in the TAPP group (7/339 vs 0/87) after a mean follow up of 23(9) and 7(4) months respectively. Other complications were similar with both the techniques. However, serious intraabdominal complications occurred in the TAPP group patients with bowel obstruction and one with severe neuralgia. These complications were not seen with a completely preperitoneal TEP approach. Although the TEP method is technically more difficult, the mean operative time in TAPP (339 patients) and TEP (87 patients) groups were similar {80(32) minutes vs 80 (41) minutes; p = 0.9}. The mean hospital stay and the times to full recovery were also similar in the TAPP and TEP groups.

There is only one randomized controlled trial comparing TAPP with TEP repair13. In this RCT, 52 patients were randomized to either TAPP or TEP. The study showed that the 2 techniques were similar with regard to the complications, time to return to activities and hernia recurrence. However, the length of stay was shorter in the TAPP group (3.7 vs 4.4 days; p=0.03).

However, since there is only one RCT involving only 52 patients, the Cochrane database review 2005 has concluded that there are insufficient data comparing TAPP and TEP techniques of laparoscopic inguinal hernia repair.

ANATOMY

Embryology

The inguinal canal is a slit like passage that extends in a downward and medial direction, just above and parallel to the lower half of the inguinal ligament. It begins at the deep inguinal ring and continues for approximately 4cm,ending at the superficial inguinal ring. The contents of the canal are the genital branch of the genitofemoral nerve, the spermatic cord in men and the round ligament of the uterus in women. Additionally, in both sexes, the ilioinguinal nerve passes through part of the canal, exiting through the superficial inguinal ring with the other contents.

The inguinal canal conveys the testis to the scrotum and forms the sheath of the spermatic cord. In males, the processus vaginalis pushes this entire inguinal 'sock' out into the scrotal swelling.

The superior rim of inguinal canal, the point of weakening and evasion of fascia transversalis, is called deep inguinal ring. The infero-medial rim of canal formed by the point of eversion of external oblique muscle is called superficial ring of inguinal canal.

The testis descends to the deep ring by the third month and completes the descent in 7 and 9 months. Between 7 and 12 weeks the

extra inguinal portion of gubernuclum shorten and pull the testis down the deep inguinal ring but then enter the inguinal canal in response to shortening of gubernaculum. The testis remains within the sub serous fascia of processus vaginalis through which they descend towards scrotum. By 9^{th} month the testis has completely entered the scrotal sac and gubernacalum is reduced to a small ligamentous band attaching the inferior pole of testis to the scrotal floor. The superior portion of the processus vaginalis is usually obliterated, leaving only a distal remnant sac, the tunica vaginalis, which lies anterior to testis.

In females, the ovaries descend into the pelvic cavity and associated with developing uterus. Therefore, the only remaining structure passing through the inguinal canal is round ligament of uterus, which is a remnant of gubernaculum.

The development sequence is completed in both sexes when the processus vaginalis obliterates. If obliteration does not occur or incomplete, a potential weakness exists in the anterior abdominal wall and an indirect inguinal hernia may develop.

Anterior abdominal wall and inguinal region

The inguinal region is the area of junction between the anterior abdominal wall and the thigh. Here a portion of aponeurosis of the

abdominal muscle inserts into the inguinal ligament and blends inferiorly with the fascia lata of thigh. The above definition adequately characterizes the external anatomy of the inguinal region, but it does not define the complex deep inguinal region. As a consequence, the superficial anterior abdominal wall and external aspect of inguinal region will be discussed as a unit.

Structure of the anterior abdominal wall

Skin and superficial fascia

The skin is loosely attached to the underlying structures except at the umbilicus where it is tethered to the scar tissue. The superficial fascia can be divided into a superficial fatty layer known as *fascia of camper* and deep membranous layer known as *scarpa's fascia*. The fatty layer is thick and is continuous with the superficial fat over the rest of the body. The membranous layer is thin and fades out laterally and above where it continues with the superficial fascia of back and thorax. Inferiorly it passes on to the front of thigh, where it fuses with the deep fascia below the inguinal ligament. In the midline inferiorly, the membranous layer of fascia is not attached to the pubis but forms a tubular sheath for the penis [or clitoris]. Below in the perineum it enters the wall of the scrotum [or labia majora] and attached on each side to the margin of the pubic arch, it

is here known as *Colle's fascia*. In the scrotum the fatty layer of superficial fascia is represented as thin layer of smooth muscle, the dartos muscle.

Deep fascia

It is a thin layer of connective tissue covering the muscles, it lies immediately deep to the membranous layer or superficial fascia. The membranous layer of superficial fascia persists as a separate layer.

Externaloblique muscle and aponeurosis

It is the most superficial muscle and its fibers directed inferiorly, medially and lie deep to the subcutaneous tissues. The aponeurosis of.the external oblique muscle is formed by a superficial and deep layer. This aponeurosis, along with the bilaminar aponeurosis of the internal oblique and transverses abdominis, forms the anterior rectus sheath and linea Alba by linear decussation. The external oblique aponeurosis serves as the superficial boundary of the inguinal canal. The inguinal ligament is the inferior edge of the external oblique aponeurosis and extends from the anterior superior iliac spine to the pubic tubercle, turning posteriorly to form a shelving edge. The lacunar ligament is formed by the insertion of the inguinal ligament to the pubis. The external (superficial) inguinal ring is an ovoid opening of external oblique aponeurosis that is positioned

superior and slightly lateral to the pubic tubercle. The spermatic cord exits the inguinal canal through the external inguinal ring.

Internal oblique muscle & aponeurosis

It is a broad, thin muscular sheet that lies deep to the external oblique muscle. Its fibers are directed superiorly and laterally in the upper abdomen and in a transverse direction in the inguinal region. The internal oblique muscle serves as superior border of the inguinal canal.

The medial aspect of the internal oblique aponeurosis fuses with fibers from the transversus abdominis aponeurosis to form a conjoined tendon. The cremastric muscle fibers arise from the internal oblique and encompass the spermatic cord.

Transverse abdominis muscle

It is a thin sheet of muscle that lies deep to the internal oblique and its fibers run horizontly forward. In the inguinal region these fibers course in a slightly oblique downward direction.

The transversalis fascia is the connective tissue layer that underlies the abdominal wall musculature. It is referred as the endoabdominal fascia and is a component of the inguinal floor.

The iliopubic tract is a continuation of the transverses abdominis aponeurosis and fascia at the upper border of the femoral sheath. The ilio

pubic tract also forms the inferior crus of the deep ring, and is also formed by the transverses abdominis aponeurotic arch. The iliopublic tract is located posterior to the inguinal ligament and crosses over the femoral vessels and inserts on the anterior superior iliac spine and inner lip of the wing of the ilium.

Inguinal canal

It is a slit like passage 4cm in length that extends in a downward and medial direction just above and parallel to lower half of inguinal ligament. It begins at deep inguinal ring and ends at superficial inguinal ring. In infants the superficial and deep inguinal rings are almost superimposed and the obliquity of this canal is slight.

Deep inguinal ring

It is an opening in the fascia transversalis 1.25 cms above the mid inguinal point between pubic symphysis and anterior superior iliac spine. It is of an oval shape, the long axis being vertical. It is larger in male than in female. At its margins the fasica transversalis is condensed. Medially it is related to the inferior epigastric vessels. It transmits the spermatic cord in male and round ligament of uterus in the female.

Superficial inguinal ring

It is an opening in the aponeurosis of external oblique muscle. It is

situated just above and lateral to the Pubic crest. The aperture is somewhat triangular with its long axis oblique corresponding to the course of the fibers of the aponeurosis. This is smaller in the females. Its base is *formed* by the pubic crest and its sides by the margins of the opening of the aponeurosis, which are called the crura of the ring. The lateral crus of the ring is stronger. There are some fibers which course at right angles to the fibers of the aponeurosis. Some of these fibers may arch over the superficial inguinal ring and called the inter crural fibers.

Boundaries of inguinal canal

- Anteriorly - skin, superficial fascia, external oblique aponeurosis and lateral 1/3 by fleshy fibers of internal oblique muscle.
- Posteriorly - transversalis fascia along the whole length,
- medially by conjoined tendon and reflected part of inguinal ligament
- Above - arched fibers of internal oblique and transversus abdominis before they *fuse* to *form* conjoined tendon.
- Below or floor- grooved upper surface of inguinal ligament and its union with transversalis fascia. At its medial end there is lacunar ligament.

Coverings of the spermatic cord

- Internal spermatic fascia - from fascia transversalis at deep ring.
- Cremasteric fascia - from muscular fasciculi of internal oblique muscle.
- External spermatic fascia - thin fibrous membrane continuous above with the aponeurosis of external oblique abdominis at the superficial ring.

Structures of the spermatic cord

- Ductus deferens.
- Artery to ductus deferens.
- Testicular artery.
- Pampiniform plexus of veins.
- Cremasteric artery and vein.
- Genital branch of genito-femoral nerve.
- Sympathetic and visceral afferent nerve fibers.
- Lymphatics.
- Remnants of processus vaginalis.

Hasselbach's triangle

It is a weak spot of anterior abdominal wall through which direct inguinal hernia protrudes. It is bounded,

Medially - by outer border of rectus abdominis

Laterally - inferior epigastric vessels

Below - medial part of inguinal ligament

Floor - fascia transversalis.

Mechanisms which prevent hernia in the inguinal region

- Obliquity of the inguinal canal.
- Shutter mechanism of arched fibers.
- Sphincter action of transversus abdominis and internal oblique muscle at the deep inguinal ring.
- Ball valve action of cremaster.
- In front of deep inguinal ring, fleshy fibers of internal oblique muscle which prevents the entry of abdominal content through the deep ring.
- Strong conjoined tendon in front of the Hasselbach's triangle to prevent direct inguinal hernia.

LAPROSCOPIC ANATOMY

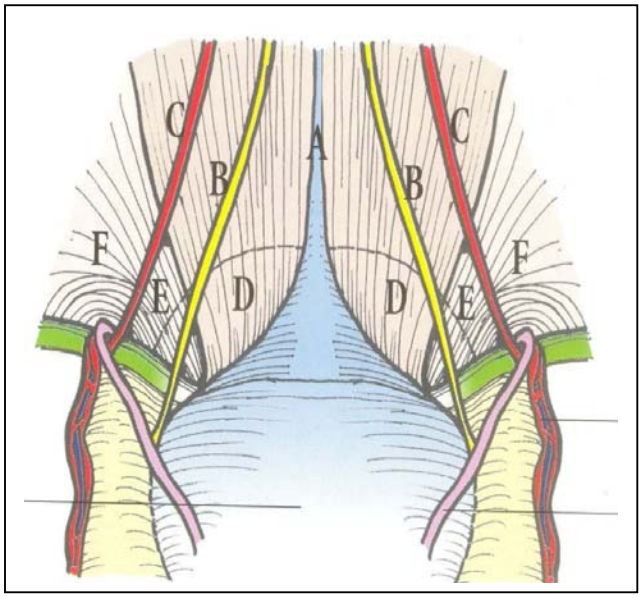
For more than a century, surgeons have been used to human anatomy as seen from outside by the naked *eye.* Elaborate diagrams showing various structures as the body layers are 'peeled away' can be found to this day. Two things were important in changing the perspective of surgeons: one - CT scans require knowledge of cross-sectional anatomy, and two - the explosion of laparoscopic surgeries mandates knowledge of views as seen from *within* body cavities. Cross-sectional anatomy is now taught in the first year of medical college, but even after 10 years, laparoscopic views are not routinely taught before the trainee embarks on a surgical career.

Laparoscopic anatomy of groin hernias

Traditionally, laparoscopic hernia repair covers sites of direct hernias, indirect hernias obturator and femoral hernias. Since all four openings are treated at one go by laparoscopic repair, the generic term 'groin hernias' is used.

The innermost layer visible by laparoscopy is the peritoneum. In the infra-umbilical region, the peritoneum is lifted by structures to form 'ligaments' and fossae. These are not true ligaments, but represent elevation of the peritoneum due to underlying structures.

LIGAMENTS AND FOSSAE



A- Median umbilical ligament

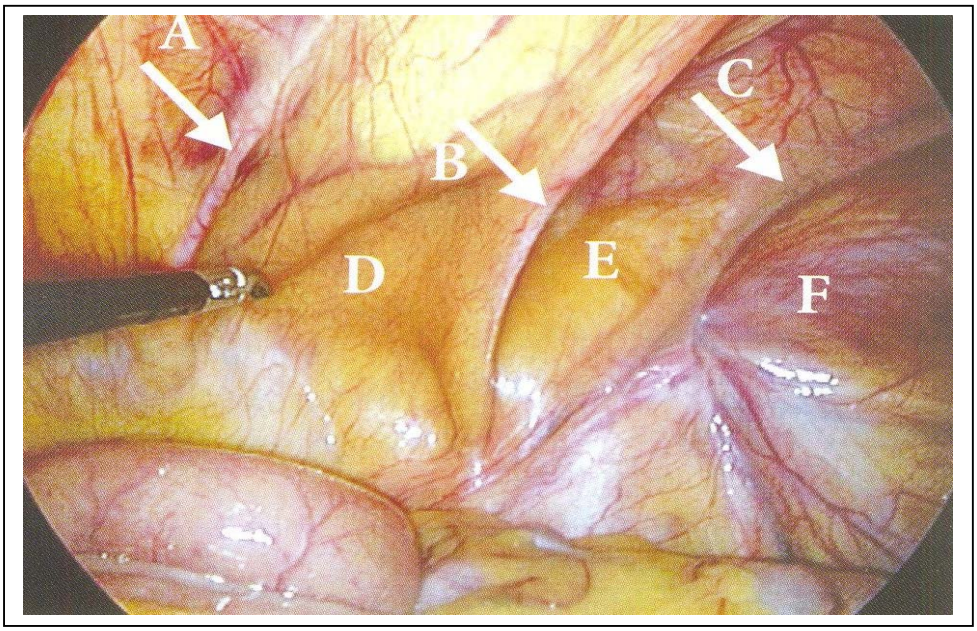
B- Medial umbilical ligament

C- Lateral umbilical ligament

D- Supra vesical fossa

E- Medial inguinal fossa

F- Lateral inguinal fossa



a) ***Median umbilical ligament***

It represents the underlying obliterated urachus, running from the umbilicus to the dome of bladder. Its division does not cause any problems.

b) ***Medial umbilical ligament***

It represents the obliterated umbilical artery, which runs from the external iliac artery to the umbilicus. It should be remembered that the proximal part (towards the iliac artery) remains patent as part of the superior vesical artery. Hence proximal injury can cause bleeding; in such a case it can be ligated or clipped without harm to the bladder. To avoid inadvertent injury to the bladder, dissection during TAPP should not extend medial to this ligament.

c) ***Lateral umbilical ligament***

Represents the underlying inferior epigastric vessels, running upwards and medially from the external iliac vessels, to run in the plane between posterior rectus sheath and the rectus muscle. Injury to these vessels should be prevented, as bleeding is enough to obscure vision. Moreover, bleeding can be hidden in the preperitoneal space. The inferior epigastric artery represents the demarcation between deep ring (indirect hernias) and the Hasselbach's triangle (direct hernia).

d) *Lateral fossa:*

Lies lateral to the lateral umbilical ligament. Site of indirect hernia.

e) *Medial fossa:*

Lies between lateral and medial umbilical ligament. Site of direct and femoral hernia (above and below ilio-pubic tract respectively).

f) *Supravesical fossa:*

Lies between medial and median umbilical ligament. Herniation does not occur here because it is supported by the rectus muscle. Some authors consider herniation at the lateral border of rectus muscle as a supravesical hernia, a type of direct hernia.

g) *Cave of Retzius:*

is the prevesical space.The medial end of the mesh lies in this space.

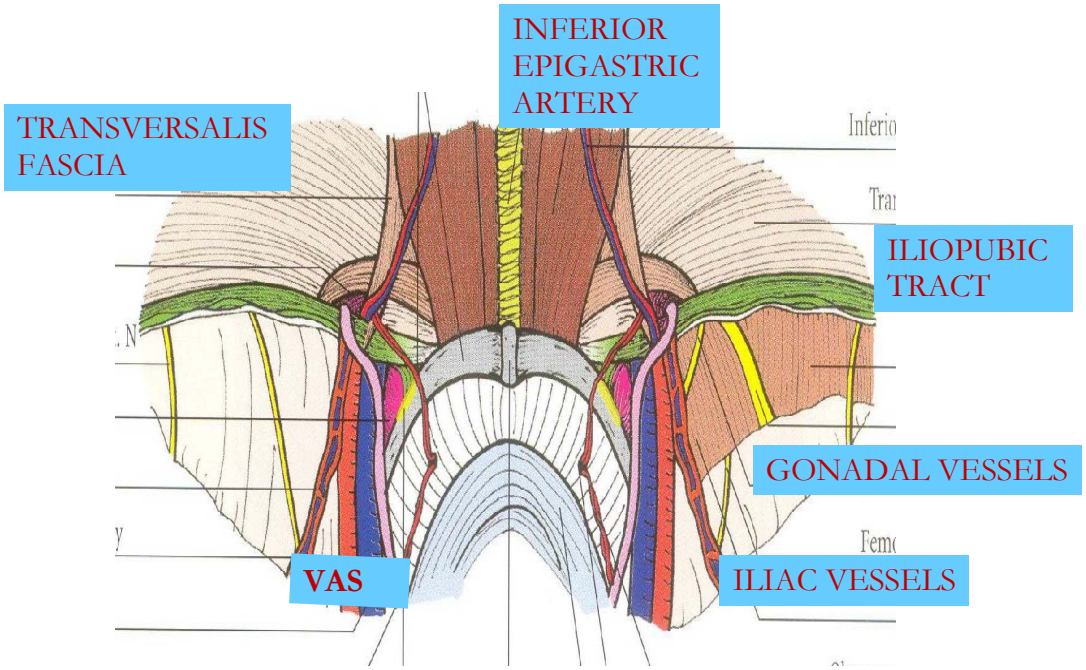
h) *Space of bogros:*

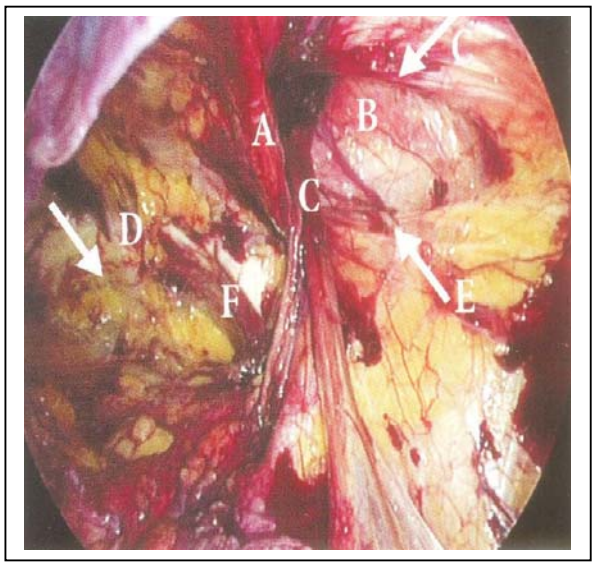
lateral extension of the cave of Retzius and extending up to the iliacus fascia. Lies between the peritoneum and the transversalis fascia. Contains a number of veins, which are a cause of postoperative haematoma. (The veins collapse due to CO2 insufflation and do not bleed during surgery)

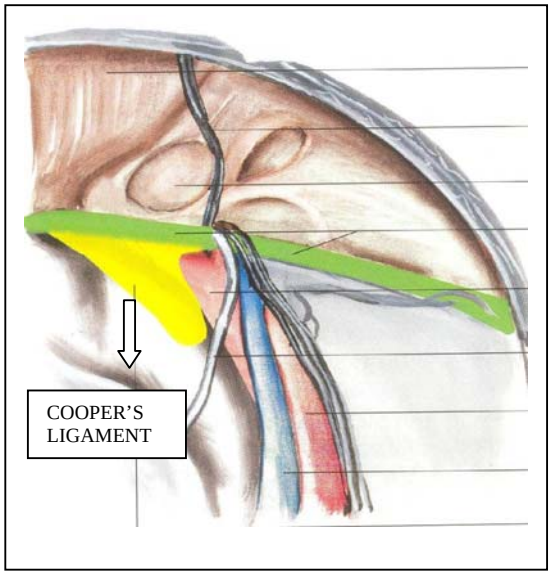
i) Transversalis fascia

Also known as the endo-abdominal fascia, it invests the inner surface of the transversus abdominis muscle and aponeurosis. The fascia as such is a

LANDMARKS AFTER REFLECTION







thin layer and does not hold sutures; however, along with the transversus *abdominis* aponeurosis it provides enough strength for a strong repair, as exemplified by the Shouldice technique. Though controversial, this fascial layer is considered to have two layers - an anterior layer in close apposition to the muscle and a posterior layer over the preperitoneal fat. The two layers enclose inferior epigastric vessels and the bladder. The posterior layer is attached superiorly to the arcuate line (free inferior border of the posterior rectus sheath). This implies that during TEP, the cannula and scope enter the space between the two layers of transversalis fascia. This is more apparent laterally, when frequently the fascia has to be sharply divided to place the mesh. Of more importance is the presence of certain condensations of transversalis fascia. These should be identified during surgery to prevent complications.

a) *Transversalis fascial sling:* Oblique migration of testis during its descent through the inguinal ligament leaves redundant fascia superior, *medial* and inferior to the deep inguinal ring. These are known as the fascial slings, and serve to narrow the deep ring during straining.

b) ***Iliopubic tract*** Condensation of transversalis fascia on the inner aspect of the inguinal ligament . Runs from the iliac crest (anterior superior iliac spine) to the pubic tubercle, where it merges with the Cooper's

ligament.Although it runs deep to inguinal ligament, it should be noted that it has no fibres from the inguinal ligament, and is discrete from it. No tacks or sutures should be applied inferior to it, since they can injure major vessels or nerves.

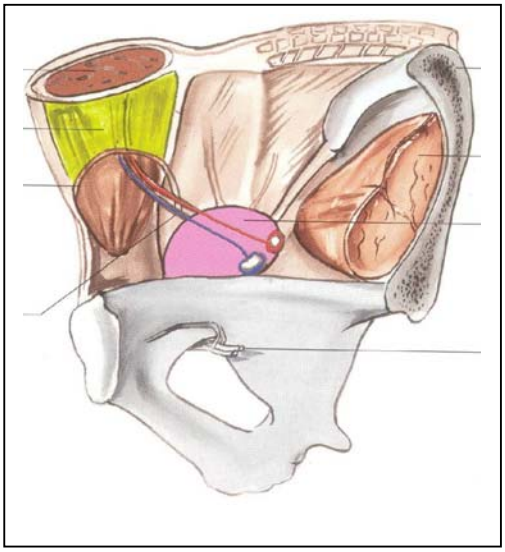
c) ***Cooper's ligament*** represents a fascial condensation overlying the superior pubic ramus .It is a strong structure and is commonly used to anchor the mesh with tacks or sutures.

d) ***Iliopectineal arch:*** Lies lateral to the iliac vessels, inferior to the ilio-pubic tract . It is attached laterally to the anterior superior iliac spine and travels medially to insert on the iliopectineal eminence. It separates the iliac vessels from the lateral compartment, containing the femoral nerve and ilio-psoas muscle.

Vas deferens

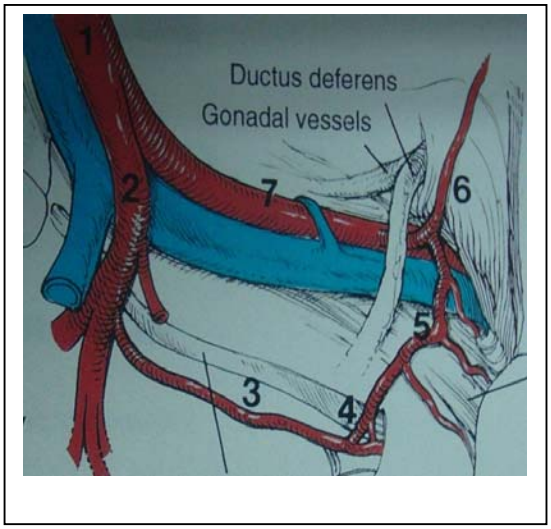
The vas deferens in males (round ligament in females) exits the deep inguinal ring and turns downwards and medially, running towards the prostate (in males). It is clearly visible through the peritoneum, and all dissection should avoid injury to it. Traction injury is most likely when dissecting an indirect hernial sac from the canal.

MYOPECTINEAL ORIFICE OF FRUCHAUD



Medial	Rectus abdominis
Lateral	Ilio psoas muscle
Superior	Fascia transversalis and internal oblique
Inferior	Bony pelvis and cooper's ligament

CORONA MORTIS



- Circle of death or death's crown
- Vascular ring formed between aberrant obturator artery and normal obturator artery and their corresponding veins

Vessels

One of the greatest disadvantages of lap hernia surgery is the possibility of major vessel injury.

1. The *gonadal vessels* are best appreciated when they exit the deep ring, passing downwards and laterally to pass under the reflected peritoneum. Thus, they diverge from the vas Medial deferens, forming a triangle, with the base formed by the reflected peritoneum, known as the *'Triangle* of Doom. This is so named because the external iliac vessels pass in this region, but may be obscured by areolar tissue. Dissection in this area can lead to a fatal vascular injury.
2. The *inferior epigastric vessels* arise from the external iliac vessels just inferior to the deep ring,and run upwards and medially to the ipsilateral arcuate line. thus tracing the inferior epigastric vessel is an easy way of locating the deep ring during TEP .
3. The *external iliac vessels* become quite superficial near the deep ring, and liable to injury. They pass under the inguinal ligament and ilie-pubic tract to continue as femoral artery in the thigh. Dissection for placement of a mesh exposes these vessels, covered by lymphoid tissue only.
4. The *obturator artery* is a branch of the internal iliac artery, and runs on the obturator internus muscle to exit the pelvis via the obturator foramen,

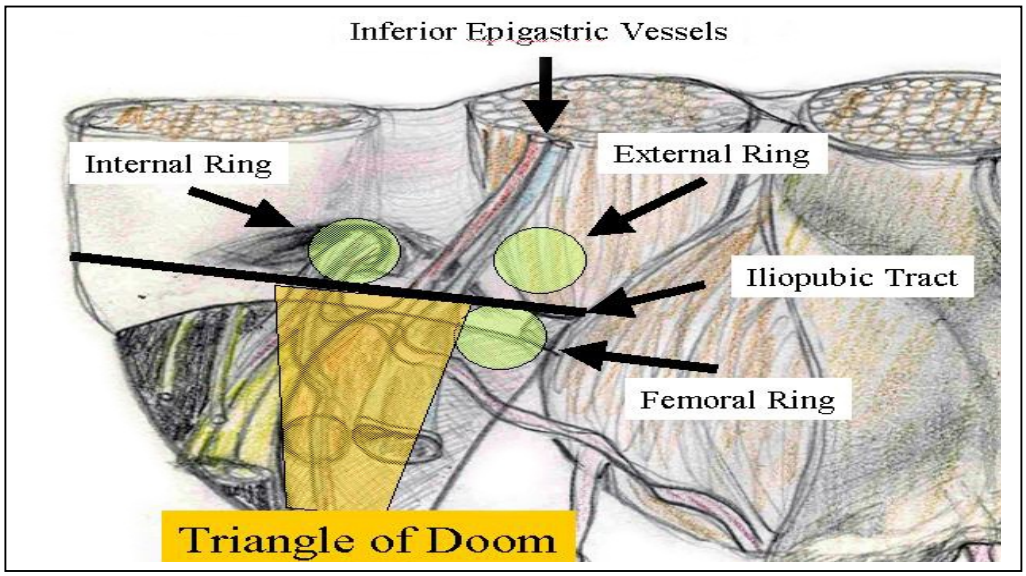
It is accompanied by the obturator vein. In 30-40% cases, there is an aberrant obturator artery arising from the external iliac artery, which crosses the iliopubic tract. At this site, it is prone to injury, causing gross bleeding. More commonly, it is the accessory obturator vein which is abnormally present, and is injured during lap surgery. This arrangement of vessels is known as the *'Circle* of *Death, Crown* of *Death,* or *Corona Mortis'*

The two nerves which surgeons are used to encountering during conventional hernia surgery, viz. ilio-hypogastric and ilio-inguinal nerves, are not seen in laparoscopic surgery. On the other hand, other large nerves are present with the potential of causing significant post-operative pain. Fortunately, they all lie lateral to the deep ring and inferior to ilio-pubic tract, in an area referred to as the *'Triangle* of *pain* Hence no tacks or sutures are applied in this region. The nerves at risk are:

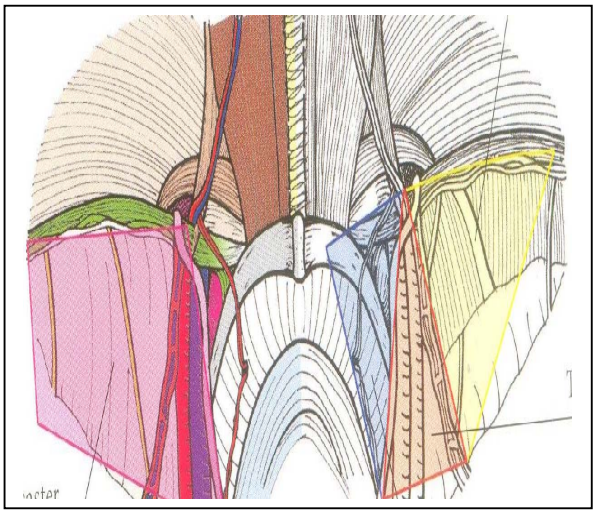
1. Lateral femoral cutaneous nerve of thigh
2. Anterior femoral cutaneous nerve of thigh
3. Femoral branch of genitofemoral nerve.

The genital branch runs on the external iliac artery to enter the deep ring.

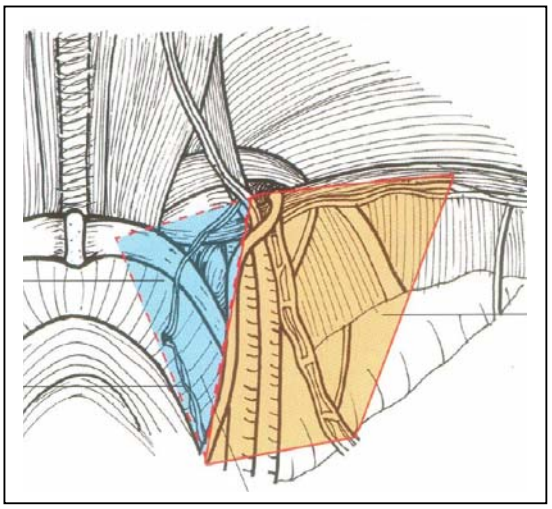
TRIANGLE AND SQUARE OF DOOM



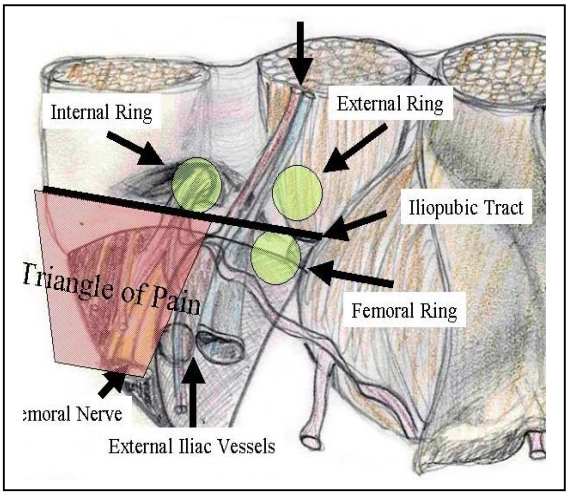
SQUARE OF DOOM

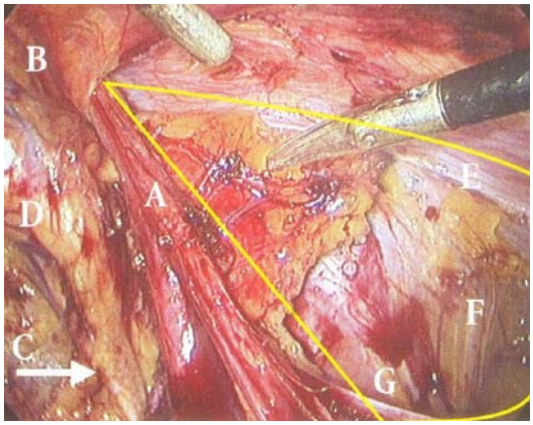


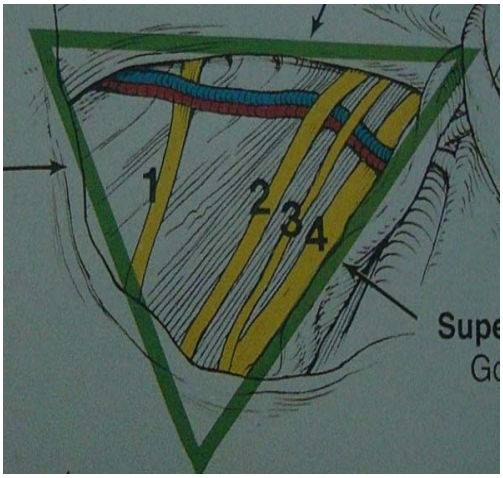
EXTENDED SQUARE OF DOOM



TRIANGLE OF PAIN







1. Genitofemoral nerve.
2. Lateral femoral cutaneous nerve.
3. Femoral nerve.
4. Anterior femoral cutaneous nerve.

4. Femoral nerve

The combination of *'Triangle* of *doom'* with the *'Triangle* of *pain'* is referred to as the *'Quadrangle* of *disaster'*. Point to note: In approximately 30% of cases, the laparoscopic anatomy of one side will *not* be a mirror image of the opposite side.

Anatomy for extra-peritoneal repair of inguinal hernias

Knowledge of the anterior abdominal wall anatomy makes understanding the access easier. Key to this approach is the fact that posterior rectus sheath terminates about 4-5cm below the level of umbilicus at the arcuate line. After incising the anterior rectus sheath to one side of the midline, the rectus muscle is retracted laterally and the space between the rectus muscle and posterior rectus sheath developed blindly. Dissection towards the pubic bone, staying in the midline, separates the peritoneum from the rectus muscle. once a trocar is in place, rest of dissection is done under vision.

ETIOLOGY

Evolution

All groin hernias share the common feature of emerging through the myopectineal orifice of Fruchaud, the opening in the lower abdominal wall bounded above by myoaponeurotic arch of the lower edges of the internal oblique and transversus abdominis muscles [conjoined tendon] and below by the pectineal line of superior pubic ramus. It serves as the passage for blood vessels, nerves, lymphatics, muscles and tendon between the abdomen and the lower limb. The space is divided into upper and lower halves by lower free aponeurotic edge of external oblique muscle [inguinal ligament] and is closed off posteriorly by the fascia transversalis.

In humans - absence of posterior rectus sheath below the arcuate line and only a rather insubstantial transversalis fascia unsupported by muscle or aponeurosis resisting the intra-abdominal pressure and holding the breach between the abdomen and thigh is compounded by upright posture leading to stretching of groin region.

Even though animals have patent processus vaginalis rarely they suffer from hernia. The reason being, thigh is flexed forwards, the groin structures are not stretched under tension and inguinal canal lies in the

upward direction. The weight of the abdominal content is directed forward and downwards away from the inguinal region.

Patent processus vaginalis

It is the prime cause of indirect inguinal hernia in infants and children. The development of processes vaginalis, its migration into the scrotum, its final obliteration are linked to the descent of the testis from the abdominal cavity into the scrotum. These processes are initiated and controlled by the calcitonin gene related peptide [CGRP]released by genito femoral nerve under the influence of fetal androgen. Between 26th and 40th week, the testis descends into the scrotum through internal ring and inguinal canal. After the testis reaches the scrotum, the lumen of processus vaginalis obliterates between internal ring and upper pole of testis.

Shutter mechanism

Straining, coughing, lifting of heavy weights and other activities increase the intra-abdominal pressure leading to risk of hernia but it is guarded by physiological shutter mechanism. It is activated when abdominal muscles contract and cause the intraabdominal pressure to increase when performing this function. As the internal oblique and transversus abdominis muscles contract, their lower fibers forming the

myoaponeurotic roof of the inguinal canal, the conjoined tendon that arches over the spermatic cord also contract sharply. As the fibers shorten, the arch straightens out and descends to lie close to or on the inguinal ligament to protect the fascia transversalis.

Contraction of transversus abdominis muscle also pulls up and tenses the crurae of internal ring, which are made up of thickened bands of ilio-pubic tract and fascia transversalis, causing the ring to close like a sphincter snuggly around the cord. At the same time external oblique muscle contracts, its aponeurosis which forms the anterior wall of inguinal canal become tense and presses on the internal ring and on the posterior wall and reinforces them by counter pressure against the intra-abdominal forces that push outward.

Raised intra-abdominal Pressure

Pregnancy, cough, lifting heavy objects, obesity, constipation, prostration, chronic ascites, liver cirrhosis, malignancy, peritoneal dialysis causes raise in intra abdominal pressure leading to the formation of hernia. Here the fascia transversalis and rest of the abdominal wall become passively stretched and thinned out. A decrease in oxytalan fibers and an increase in the amorphous substance of elastic fibers as function of age may be responsible for alterations in the resistance of transversalis

fascia and high incidence of groin hernia in older men.

The integrity of fascia transversalis

The fascia transveralis on its own is not a very strong layer of abdominal wall. The ability of it is dependent on the state of collagen fibers that make up its tissues and give its strength. It may be thinned out by factors that interfere with normal production collagen or increased production of abnormal collagen fibers or excessive destruction of collagen. The Marfan's, Ehler's- Danlos, Hurler-Hunter's syndromes and mesenchymal defects are predisposing factors for groin hernias.

In smokers, the circulating unopposed enzymes upset the protease / antiprotease system in the blood and bring about destruction of elastin and collagen of rectus sheath, fascia transversalis and cause their attenuation and predispose to herniation.

General factors

Systemic illness, adiposity, lack of exercise, multiple pregnancies, operative incision for gynecological, urological and appendicectomy procedures predisposes to hernia formation.

Recurrent inguinal hernia

Its incidence after primary repair varies from 1 % in specialized centers to 30% in general surveys. Most recurrences appear within 2-3

years of primary repair and are called early recurrences due to technical failure and infections. Any recurrences after 2-3 years are called late recurrences and are usually due to tissue failure.

Causes of Recurrence :

- Suture tension
- Infection
- Absorbable suture material
- Smoking
- COPD
- Chronic constipation
- Collagen disorders
- Failure to ligate the sac at the neck
- Ascites
- Missed hernias
- Repeated repairs
- Sliding hernias
- Large and long standing hernias
- General condition of the patient like malnutrition, jaundice, malignant disease etc.

PATHOLOGY

Hernia consists of three parts namely the sac, contents of the sac and coverings of sac

Sac

It is a pouch of peritoneum which comes out through the weakened abdominal musculature and being covered by layers. It is divided into 4 parts.

- Mouth - opening of the sac through which contents enter the sac
- Neck of the sac - most constricted part
- Body-main portion of the sac
- Fundus-most redundant part of sac

Contents of sac

The viscus, which lies within the sac of hernia, is called content. Depending on the content, the hernia is

- Omentocele - content is omentum
- Enterocele - loop of intestine
- Richter's - is a portion of circumference of intestine
- Sliding hernia - portion of bladder, sigmoid colon etc., may slide into hernia
- Litter's hernia - content is Meckel's diverticulum.

Coverings of Sac

Are the layers of the abdominal wall, which cover the hernial sac.

Coverings of the indirect inguinal hernia

From inside out

- Peritoneum
- Extra peritoneal fat
- Internal spermatic fascia
- Cremasteric fascia and muscles
- External spermatic fascia
- Superficial fascia
- Skin

Coverings of direct inguinal hernia

Hasselbach's triangle is divided into medial and lateral halves by the obliterated umbilical artery. A direct hernia leaves this through its outer or inner part.

Lateral direct hernia **-** same as indirect hernia except that, the covering it receives from the fascia transveralis is not that part of the fascia prolonged from the margins of the internal ring. The inferior epigastric artery is lateral to the hernial opening.

Medial direct hernia

- ❖ External Spermatic fascia
- ❖ Falx inguinalis or conjoined tendon
- ❖ Fascia transversalis

INVESTIGATIONS

1. Routine investigation
   - ❖ Hb% BT, CT
   - ❖ Urine examination for albumin, sugar and microcopy.
   - ❖ RBS, Blood urea, S. Creatinine.
   - ❖ E.C.G.
2. Chest-X-ray P A view - to rule out chronic. bronchitis, chronic obstructive pulmonary disease changes / pulmonary tuberculosis and cardiomegaly.
3. Ultrasound of abdomen in selected cases.
   - ❖ To rule out BPH, mass abdomen, hepatosplenomegaly, hydronephrotic without clinical findings.
   - ❖ Undetermined palpable masses of the inguinal region.

TREATMENT OF INGUINAL HERNIA

Operative Treatment :

Generally, types of operations performed are :

	Open	Laproscopic
1.	Herniotomy	TAPP
2.	Herniorrhaphy	TEP
3.	Hernioplasty	

LAPAROSCOPIC REPAIR

The most common laproscopic technique involves a transabdominal preperitoneal repair[TAPP] or a totally extraperitoneal repair [TEP] of groin hernia . Laproscopic intraperitoneal onlay methods [IPOM] have not been widely employed largely due to the potential for development of intraabdominal adhesions to exposed mesh.

A laproscopic approach for hernia repair have been advocated because it

1) enables a thorough intraabdominal examination
2) provides visualization of both the inguinal regions
3) allows for visualization of incarcerated hernias and evaluation of strangulated tissue(non viable tissue,omentum or intestine may be resected laproscopically)

4) permits thorough exploration of the myopectineal orifice described by fruchaud.

5) permits use of mesh sufficient to cover the entire myopectineal orifice with adequate overlap

6) avoids extensive mobilization of spermatic cord

7) avoids scar tissue encountered during repair of recurrent hernia.

Laproscopic access allows the surgeon to approach a groin hernia from its point of origin in the abdomen, not its point of presentation on the abdominal wall. The entire myopectineal orifice, including the femoral canal as well as the direct and indirect inguinal rings can be secured against herniation.

An additional benefit of laproscopic hernia repair may be the avoidance of cord mobilization during repair. Extensive mobilization can cause operative trauma to cord structures and possibly vein thrombosis. It has been suggested that thrombosis of the testicular veins is the underlying pathology in the genesis of ischaemic orchitis and subseqent testicular atrophy.

Laproscopic hernioplasty has several advantages over its open counter parts. First and foremost is the reduced post op pain and short recovery period. The entire myopectineal orifice can be inspected,

allowing for repair of unexpected hernias thereby reducing the chance of recurrence. Laproscopic hernioplasty avoids the previous operation scar site in patients with recurrent hernias.

Absolute contraindications

1) patient unsuitable for general anaesthesia
2) active infection or inflammatory process
3) an incarcerated hernia
4) large irreducible long standing scrotal hernia

Relative contraindications

1) prior laproscopic hernia repair on the same side
2) prior pelvic lymph node dissection or other pelvic surgeries
3) prior groin irradiation
4) small congenital hernia

TRANSABDOMINAL PRE PERITONEAL REPAIR (TAPP)

Preoperative preparations :

Patient is given antibiotics

A foley catheter is placed

Skin is prepared with povidine iodine and spirit

Instrumentation :

30 degree 10 mm telescope, veress needle, 10mm trocars, 5 mm

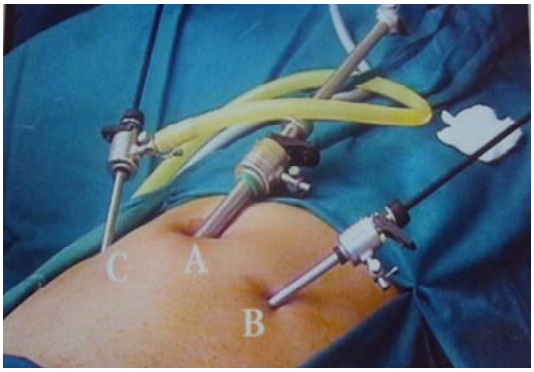
trocars, holding forceps, Maryland dissector, scissors, 10mm to 5 mm reducing sleeve, 5 mm needle holder, Electro surgical apparatus – Mono polar / bipolar, prolene mesh (or other meshes – ex. 3 D mesh), conventional suture materials (1-0 prolene, 2-0 vicryl) or tacks.

Operative Technique :

Access to abdomen is gained by Hassons's technique or Veress needle approach.(We commonly prefer Hasson's technique) Operating 5mm ports were introduced in the right and left pararectus regions below the umbilicus. Next step is reduction of contents. Then peritoneal flap is created by a horizontal incision 2 cms above the defect extending from the medial umbilical ligament to the anterior superior iliac spine. Then peritoneal flaps are raised. Medial dissection is done if there is a direct hernia were separation of pseudosac is done from the peritoneum and preperitoneal fat. Lateral dissection is done for separation of indirect sac from cord structures. Then parietalisation is done. Extend of dissection is beyond the midline on the medial aspect, beyond the anterior superior iliac spine exposing the psoas muscle in the lateral aspect, inferiorly upto the symphysis pubis and level of obturator foramen and superiorly upto the level of working trocars. Then the mesh introduced and placed in such a way that it covers the entire myopectineal orifice of Fruchaud.

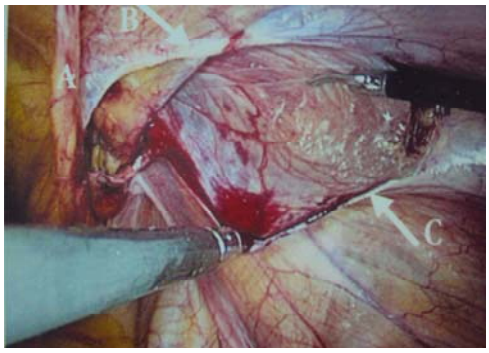
TRANSABDOMINAL PREPERITOENEAL REPAIR (TAPP)

1.POSITION OF PORTS

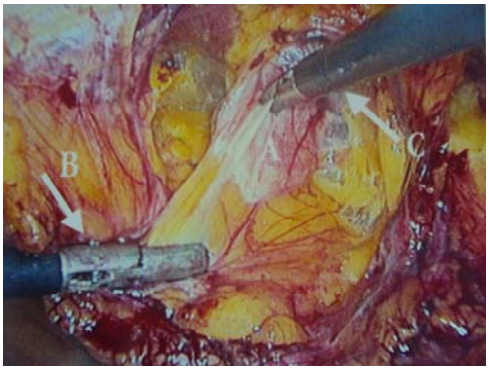


2. INCISION OF PERITONEUM

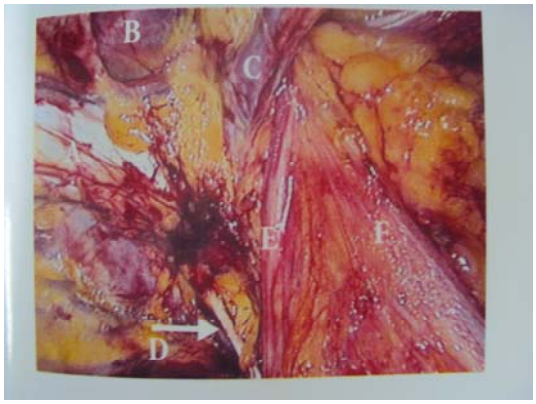
3.COMPLETION OF PERITONEAL INCISION



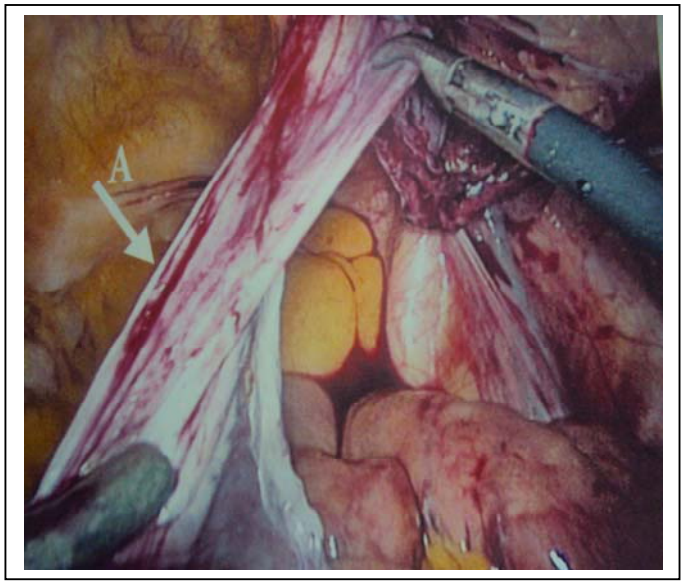
4.MEDIAL DISSECTION IN DIRECT SAC



5.COMPLETION OF MEDIAL DISSECTION



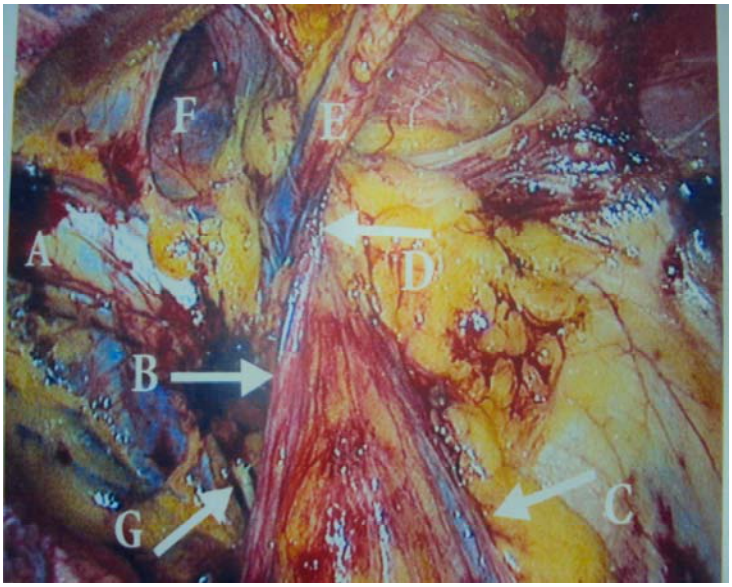
A-RIGHT PUBIC RAMUS
B-DIRECT DEFECT
C-INFERIOR EPIGASTIC VESSELS
D-OBTURATOR VESSELS
E-VAS DEFERENS
F-TESTICULAR VESSELS



6. DISSECTION OF SAC EXTENDS INTO THE INGUINAL CANAL

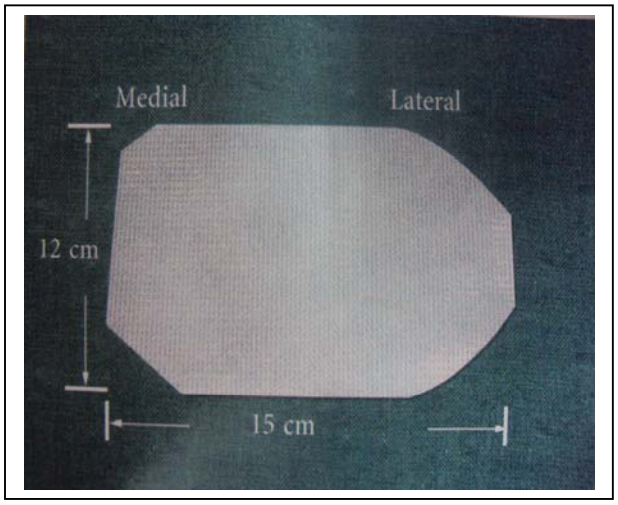
A- SAC

7. AFTER COMPLETION OF MEDIAL AND LATERAL DISSECTION

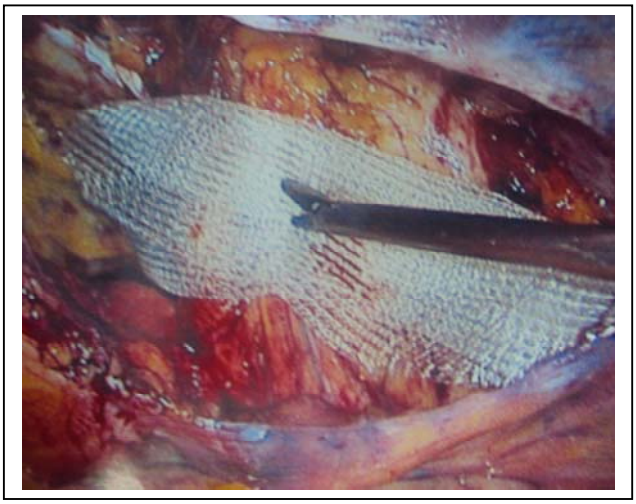


A-RIGHT PUBIC RAMUS
B-VAS DEFERENS
C-SPERMATIC VESSELS
D-INTERNAL RING
E-INFERIOR EPIGASTRIC VESSELS
F-DIRECT DEFECT
G-OBTURATOR VESSELS

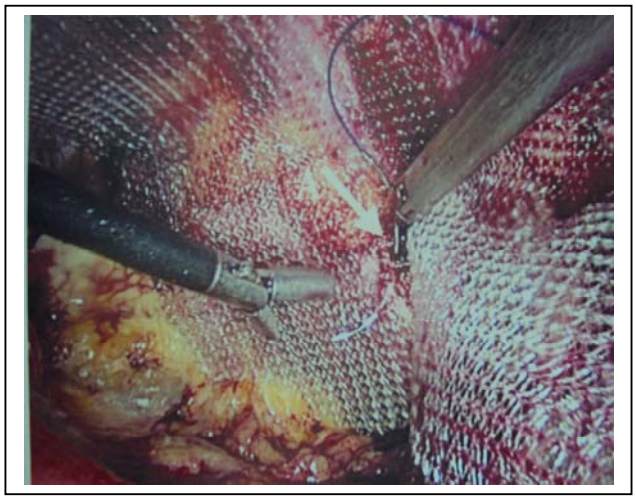
8.SIZE OF MESH AND TRIMMING



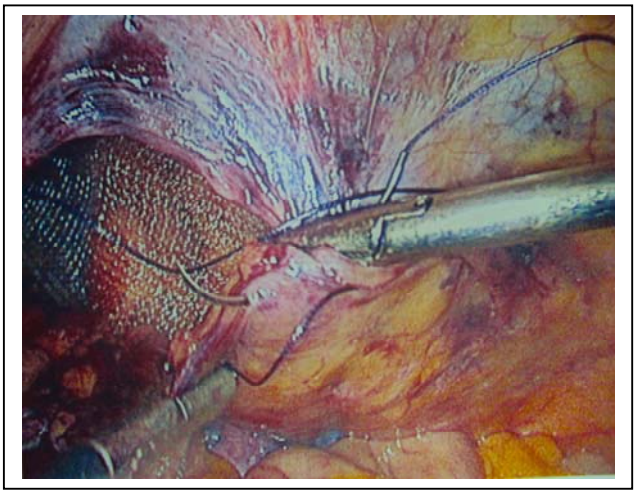
9.MESH KEPT OVER DISSECTED AREA AND UNFOLDED



10.FIXATION OF MESH TO COOPERS' LIGAMENT



11.CLOSURE OF PERITONEUM



Mesh is fixed with prolene or tacks. Peritoneom is closed with 2 – 0 vicryl. Then pneumoperitoneum is evacuated and port sites closed with vicryl.

Post operative management of laproscopic surgery :

We apply compression dressing in the inguinal region to prevent seroma formation. Fluids are allowed from the first post operative day. Antibiotics and analgesics are given for 24 hrs. Patients routinely discharged on the fourth post operative day.

TOTALLY EXTRA PERITONEAL REPAIR (TEP)

Preoperative preparation is similar to TAPP repair,

Operative Technique :

Extra peritoneal space creation can be done in the blunt introduction of 10mm laproscope (0 degree). Zero degree scope is used for initial space creation then changed to 30 degree scope for rest of the dissection.

Procedure is begun with a 12 mm subumbilical incisions, 10 mm trocar is introduced and extraperiotoneal dissection is done. The dissected space is maintained by continuous CO2 insufflation at 12 – 14 mmHg. The space created is widened by moving telescope at various

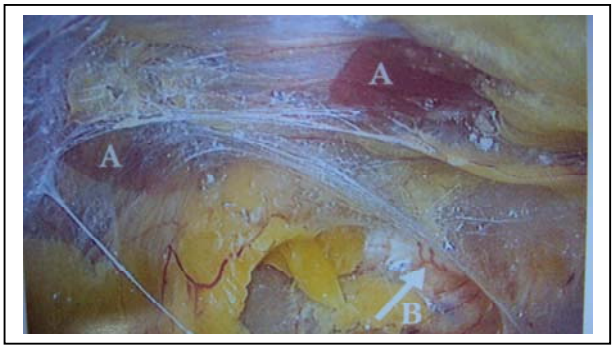
directions.(This can be also done with a balloon dissector.) Working port is created inbetween the subumbilical port and pubic symphysis. Second trocar is then introduced in the extra peritoneal space on the side of the hernia. Medial and lateral dissection are done to separate direct and indirect sacs. Then parietalisation is done. Then mesh is placed covering the entire myopectineal orifice. Then mesh is fixed to Cooper's ligament and rectus muscle. Finally CO2 is released slowly by opening the side channel of 5 mm port while inferior aspect of the mesh is held against rectus muscle. Then port sites are closed with vicryl. Post operative management is similar to TAPP

TOTALLY EXTRAPERITONEAL REPAIR (TEP)

1.EXPOSURE OF EXTRAPERITONEAL SPACE

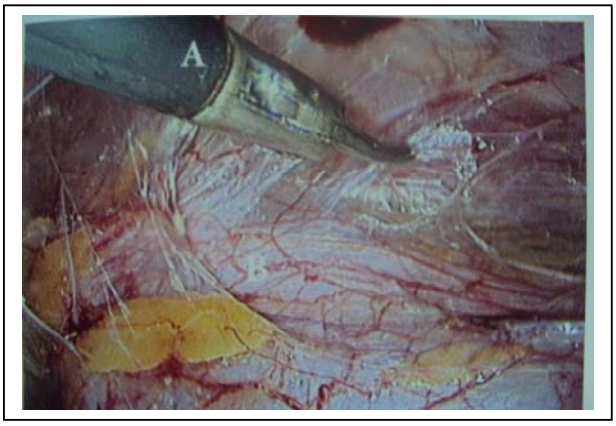
2.COBWEB APPEARANCE OF PREPERITONEAL AREOLAR TISSUE

3.DISSECTION WITH SCOPE AND CREATION OF PREPERITONEAL SPACE



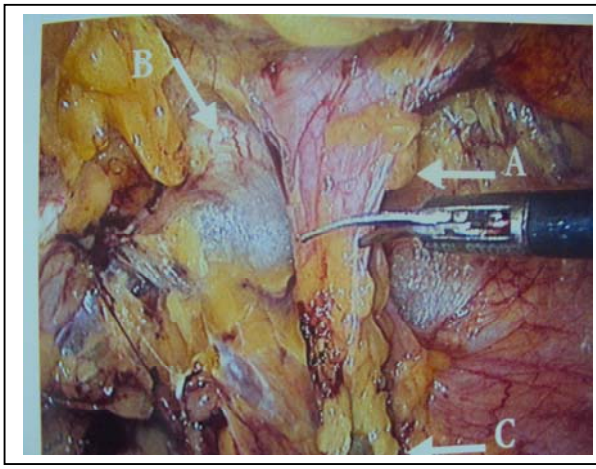
4. INTRODUCTION OF LEFT HAND WORKING TROCAR

5.WIDENING OF EXTRAPERITONEAL SPACE ON LATERAL ASPECT

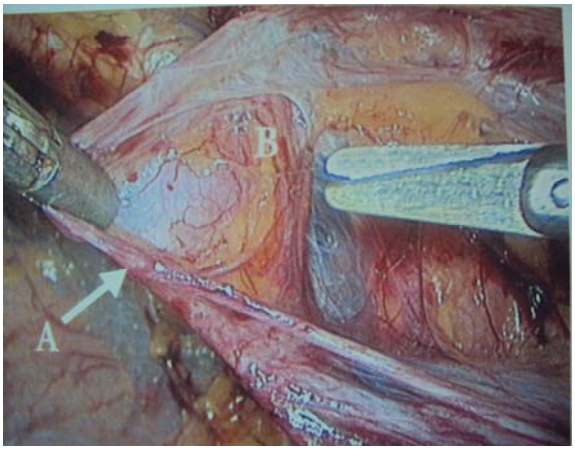


6.TWO HANDED DISSECTION

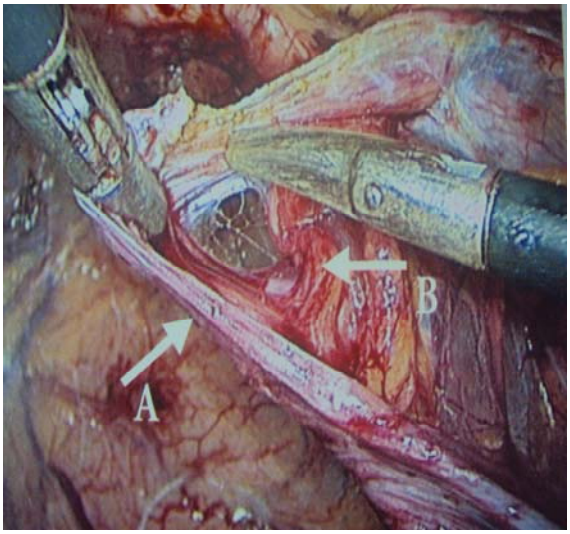
7.SEPERATION OF PSEUDOSAC FROM PERITONEUM



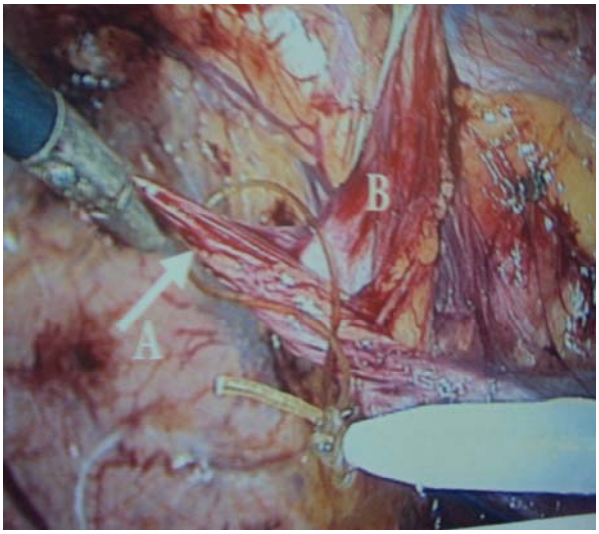
8.SEPERATION OF SAC FROM CORD STRUCTURES



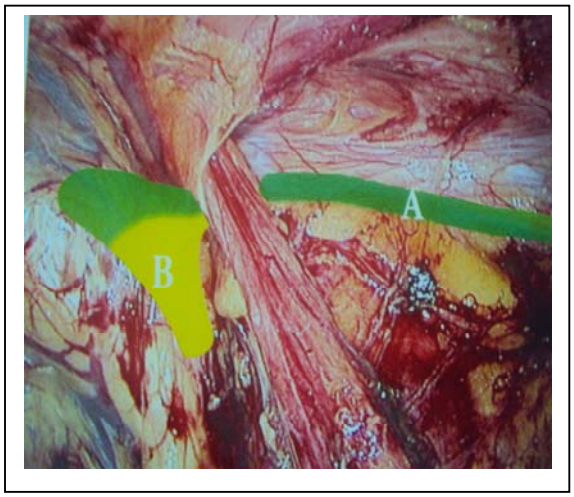
9.DIVISION OF SAC AFTER DISSECTION



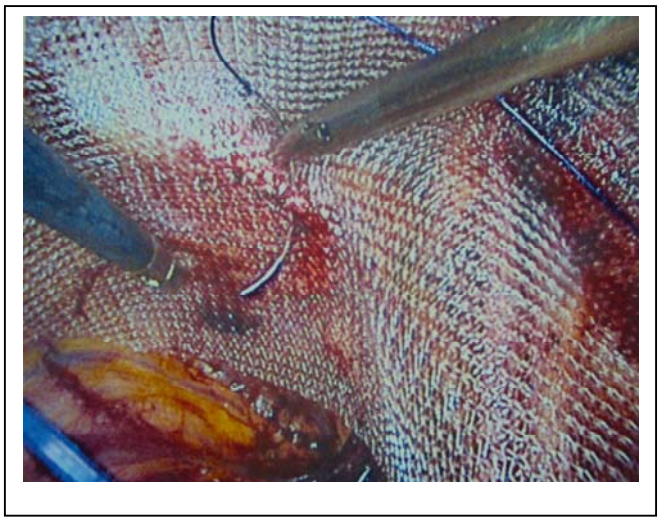
10.ENDOLOOP APPLIED TO PROXIMAL SAC AFTER DIVISION



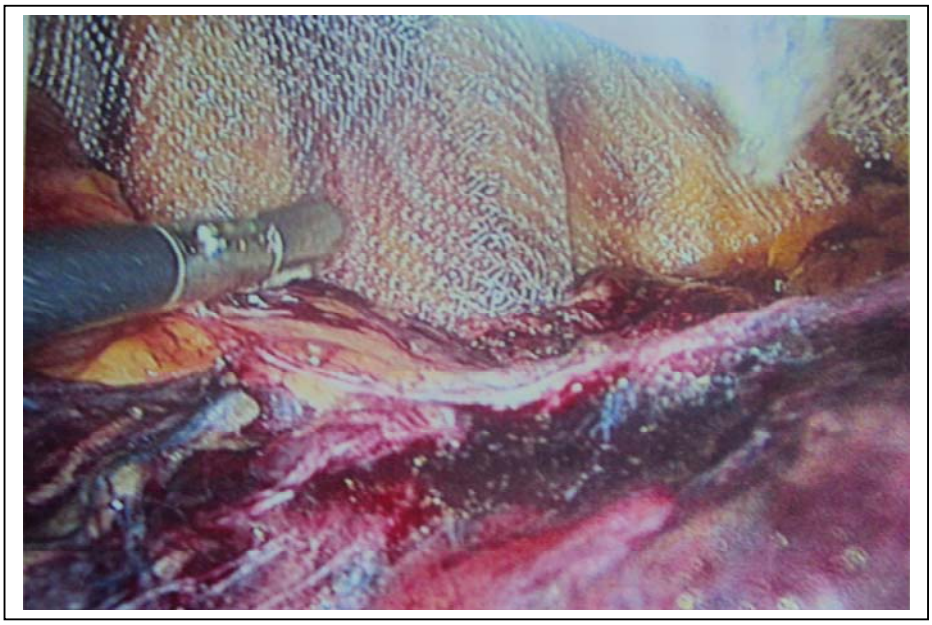
11.IDENTIFICATION OF COOPER'S LIGAMENT



12.FIXATION OF MESH TO COOPER'S LIGAMENT



13.MESH BEING HELD AT THE LOWER BORDER DURING THE DESUFFULATION OF CO2 TO PREVENT ROLLING OF THE MESH



COMPLICATIONS OF INGUINAL HERNIA REPAIR

General Complications

Urinary retention, paralytic ileus, nausea and vomiting, aspiration pneumonia, cardiovascular and respiratory insufficiency.

Local Complications

- Haemorrhage
- Ecchymosis around the skin .incision
- Scrotal haematoma

Infection

Diabetes mellitus, renal failure, alcoholism, malnutrition and obesity increase the infection rates. It is the main cause for recurrence of hernias.

The staphylococcus aureus, staphylococcus epidermidis and E. coli are the most common pathogens to be encountered in elective inguinal hernia repairs. Wound infection varies from the minor redness of skin edges, serous discharge, and stitch abscess to the more serious cellulitis in and around wound that may progress to necrotizing fascitis.

Bladder injury:

Occurs when dissecting the large direct sac.

Cord and Testicular complications

Hydrocele

This occurs especially if the distal sac is ligated, but if the distal sac is left unclosed, the incidence decreases. It brilliantly transilluminates.

Haematocele

It is a collection of blood in the distal sac in patients with a patent processus. There is a swelling of the cord and scrotum with associated pain. The source of the bleeding in these patients is either from the cut edges of the distal sac, from the testicular artery or from the pampiniform plexus of veins.

Ischaemic orchitis and Testicular Atrophy

Ischaemic orchitis is insidious in onset and become obvious between 2 and 5 days post operatively. The patients complain of pain, swelling and on examination a hard tender cord, epididymis and testis are found. The testis is also retracted upward in the scrotum. The pain and tenderness lasts for several weeks.

The ischaemic orchitis may subside completely without any residual damage to the testicle, but in some patients testicular atrophy occurs. It is important that the patient is reassessed periodically for at least for 1 year, because atrophy may become apparent during that time.

Extensive dissection within the cord and the cremaster for removal of the sac of the hernia damages the venous plexus and the venous blood flow. Division of the sac without removal of the distal sac decreases the incidence of ischaemic orchitis and subsequent testicular atrophy.

Vas deferens injury

Dysejaculation syndrome results from trauma to the vas during surgery and it results in scarring and narrowing of the lumen of the vas. The patient experiences a searing, burning pain sensation throughout the groin at the time of ejaculation. Transection usually occurs in open repairs, particularly in recurrent herniorrhaphy.

Bowel injury:

Small and large bowel (caecum or sigmoid) injury occurs when they form part of wall of a sliding hernia.

Nerve injury: There are four types of neuralgias

(i) Neuroma pain: Common type, caused by proliferation of nerve fibres outside the neurilemma following complete or partial nerve dissection. Pain is like an electric shock.

(ii) Deaffemtiation pain: A burning pain following complete or partial nerve section or entrapment in a ligature.

(iii) Projected pain: Intact nerve encased in a callus or entrapped in ligature.

(iv) Referred pain: The lesions are at a distance, such as an inflammatory granuloma around a suture or the stump of a peritoneal sac. *Bone* - osteitis pubis as a result of periosteal bite taken at the pubic tubercle.

Recurrences

Remains the most common complication of hernia surgery and ranges from 2.3% to 20% for inguinal hernias.

Mesh related complications

During the first. few days after implantation of meshes a collection of liquid around the mesh can be detected by ultrasound. These extended seromas are caused by destruction of lymphatic vessels, and they reflect as well the inflammatory potency of the alloplastic material. At the same time, the patient's body temperature shows a slight increase to 38^{o}C after implantation of large pieces of mesh. Correspondingly a rise of C-reactive protein indicates an acute inflammatory process. The spread of inflammation to adjacent structure is confirmed by CT, ultrasound revealing a thickened spermatic cord after implantation of meshes in the inguinal region.

Clinically apparent extent of inflammatory response shows remarkable variations between patients.

Infection

Studies have demonstrated that the implantation of meshes does

not increase the risk of infection. With or without mesh, the infection rate varies between 1% to 5%

Mesh Shrinkage

The extent of mesh shrinkage as a result of physiological wound contraction reflects mainly the activity of the inflammatory reaction. Animal experiments have confirmed that for heavy weight prolene meshes, a reduction of mesh area of about 40% after 6 weeks is seen, where as the shrinkage seems to be less for light weight meshes.

Mesh related complaints

Mesh implantation not only strengthens the abdominal wall but sometimes leads to a considerable restriction of the abdominal wall mobility as well as to a high rate of complaints in upto 50% of all patients, particularly after implantation of a large piece of mesh.

Mesh migration and fistula formation

The migration of a mesh with the formation of the fistula mostly occurring to bowels and bladder is a serious complication of mesh surgery

MATERIALS AND METHODS

Government Rajaji Hospital is a tertiary care centre in Madurai, Tamilnadu. It has the privilege of having maximum number of outpatients in South Tamilnadu.

Hernia is one of the common surgical problems presenting to our everyday outpatient department. We have been performing both TAPP and TEP procedures for hernia repair in the department. Both these procedures are well standardized.

The purpose of this study is to compare post operative outcomes and clinical effectiveness between laparoscopic TAPP and laparoscopic TEP for inguinal hernia repair..

1. Duration of study was from September 2009 to August 2011..

SELECTION OF STUDY SUBJECTS:

Age eligible for study	:	18 years to 80 years
Genders eligible for study	:	Both

Inclusion Criteria:

1. All patients with uncomplicated symptomatic inguinal hernia attending the out patient department of surgery at Government Rajaji Hospital, Madurai will be included.

2. The diagnosis of inguinal hernia will be made clinically.

Exclusion Criteria:

1. Co-morbid conditions making the patients unfit for general anaesthesia
2. Complicated hernia.
3. Uncorrectable coagulopathy.
4. Morbid obesity (Body Mass Index > 30).
5. Suspected intra-abdominal or pelvic malignancy

DATA COLLECTION:

1. Serious adverse events (including visceral injuries and vascular injuries)
2. Pain
3. Hernia recurrence
4. Conversion
5. Haematoma
6. Seroma
7. Wound/Superficial Infection
8. Mesh/Deep Infection
9. Port site hernia
10. Length of hospital stay (Days)
11. Time to return to usual activities (Days)
12. Persisting numbness

Through clinical examination and direct interview with the patient by Questionnaire method.

METHODOLOGY:

1. Diagnosis of Inguinal hernia by clinical examination.
2. Checking for patient selection by above mentioned method.
3. Laparoscopic inguinal hernia repair done by either TEP or TAPP approach.

Pre-operative Preparation:

Single dose of injection Cefotaxim 1 gm i.v. will be given as prophylaxis preoperatively. Part will be shaved and cleaned properly. Patient will be catheterized before the start of the procedure.

Operative Procedure

General Anesthesia-

Patient will be placed in supine position with both upper limbs by the side of the patient. Induction will be done by succinyl choline and maintenance by O2+N2O+Halothane and Atracurium. Patients will be kept on intermittent positive pressure ventilation during the procedure.

Technique of TAPP repair:

Pneumoperitoneum upto 14 mmHg will be created with CO2 using Veress needle at umbilicus. A standard 10 mm trocar will be placed 1 cm below the umbilicus for insertion of laparoscope. Two additional 5 mm trocars will be placed at the same level approximately 5-6 cm on either side of the umbilicus. The contents of the inguinal hernia (if any) will be pulled back into the abdomen. A short curved incision will be made lateral to the inguinal ring extending transversely below the semilunar line, to enable the formation of a peritoneal flap until the identification of the inferior epigastric vessels medially. The rectus muscle will be used to identify the pubic tubercle and Cooper's ligament.

After the dissection, a rolled piece of polypropylene mesh (10x15 cm) will be introduced via umbilical port into the abdomen. After unrolling the mesh, it will cover the entire inguinal area on the affected side. No tacker will be used to fix the mesh. The peritoneal flaps will be closed back to cover the mesh completely using absorbable suture 2-0 vicryl; this is to prevent adhesions between mesh and intestine. The CO2 will be released, the midline trocar fascia will be closed, and then the other trocar sites will be closed with simple suture using 2-0 silk.

Technique of TEP Procedure:

All three ports will be made in the midline. A 10 mm port just below the umbilicus will be made for telescope. The rectus muscle will be retracted laterally after incising the rectus sheath and a blunt dissection done using the telescope to create preperitoneal space until the pubis is felt. Two 5 mm ports will be made, one just above the pubis and the other in the midline between 10 mm port and 5 mm pubis port. The entire posterior floor will be dissected and the anatomical landmarks recognized. A single sheet of mesh will be introduced. If the peritoneum or hernial sac gets inadvertently opened during dissection, it will be sutured or ligated with a chromic endoloop, if possible. The mesh will be left in the preperitoneal space adequately covering the deep inguinal ring, Hasselback's triangle and femoral hernia site. No tacker will be used to fix the mesh. The CO2 will be released. The 10 mm port fascia will be closed using 1-0 vicryl, and then the 5mm port sites will be closed with simple suture using 2-0 silk.

Any intra-operative complications like vascular, nerve or vas injury, peritoneal breach and serious visceral injuries will be recorded.

The operative time will be recorded as the time from the incision until the last skin stitch.

Any conversions from totally extra peritoneal technique to transabdominal preperitoneal technique and from laparoscopic to open repair will be recorded with the specific reason for conversion.

For postoperative pain relief, injection diclofenac sodium 75 mg i.m. and for vomiting injection ondansetron 8 mg i.v. will be given post-operatively in the recovery room to all patients. Pain will be recorded at 1, 6, 24 hours after operation, at the time of discharge and during follow up on a Visual Analogue Scale (VAS) with end points labeled as no pain and worst possible pain on a scale of 10.

Visual analogue scale No pain to Worst possible pain

0 1 2 3 4 5 6 7 8 9 10

Extra analgesic and antiemetic requirements, post-operative time to resume feeding, return of bowel activity, total hospital stay, any urinary retention will be the other variables measured post-operatively.

Complications including haematoma / seroma formation and wound infections will be recorded.:

Recurrence and cosmesis will be recorded during follow-up.

4. Post operative outcomes assessed on the basis of primary and secondary outcomes by clinical examination and direct interview with the patient through a Questionnaire.
5. Follow up was done at outpatient department at 3 months, 6months to look for late complications like recurrent hernia and mesh infection or rejection.
6. Post operative outcomes were compared between TAPP and TEP group and statistically analysed using Chi-square test and the significance noted.

The below mentioned statistical tools were used in this study. The information collected regarding all the selected cases were recorded in a Master Chart. Data analysis was done with the help of computer using **Epidemiological Information Package (EPI 2010)** developed by Centre for Disease Control, Atlanta.

Using this software range, frequencies, percentages, means, standard deviations, chi square and 'p' values were calculated by One way ANOVA and ‘t’ test. Kruskul Wallis chi-square test was used to test the significance of difference between quantitative variables and Yate’s chi square test for qualitative variables.

A 'p' value less than 0.05 is taken to denote significant relationship.

RESULTS

Table - 1

Age wise distribution

Age in years	TEP	TAPP	TOTAL	%
18-30	6	13	19	21.33
31-40	11	7	18	25.33
41-50	11	7	18	25.33
51-60	12	3	15	20.00
61-70	5	0	5	6.66
71-80	0	0	0	1.33
Total	45	30	75	100

About 50.66% cases were found to be between age group of 31-50 years.

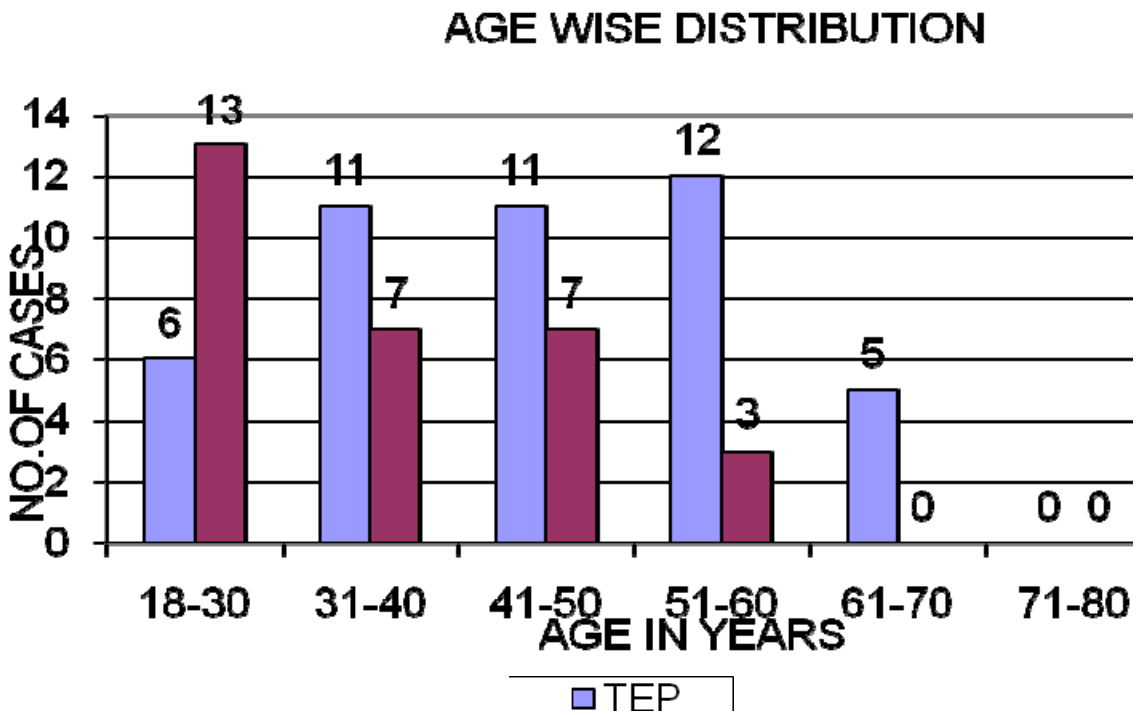

AGE WISE DISTRIBUTION
NO.OF CASES
14
12
10
8
6
4
2
0
13
11
11
12
6
7
7
3
5
0
0 0
18-30
31-40
41-50
51-60
61-70
71-80
AGE IN YEARS
TEP

Table – 2

Type of Hernia

Type	TEP	TAPP	No. of cases	Percentage
Direct	17	9	25	33.33
Indirect	24	21	46	61.33
Bilateral	4	0	4	5.33
Total	45	30	75	100

In this study, the predominant type of hernia operated was Indirect inguinal hernia (61.33%)

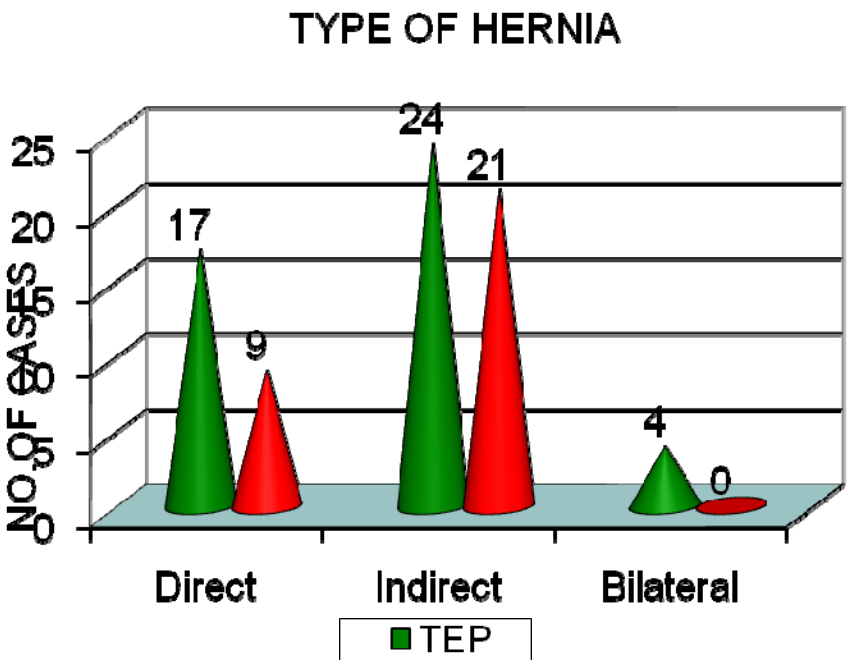

TYPE OF HERNIA
NO. OF CASES
25
20
15
10
5
0
17
9
24
21
4
0
Direct
Indirect
Bilateral
TEP

Table - 3

Post operative Complications

Complications	**Laproscopy**			
	TAPP (n=30)	**%**	**TEP (n=45)**	**%**
Wound infection	1	3.33	1	2.22
Seroma/ Haematoma	0	0	2	4.44
Pain	9	30.0	3	6.66
Recurrence	0	0	1	2.22
Conversion	1	3.33	2	4.44
Serious adverse events	1	3.33	0	0

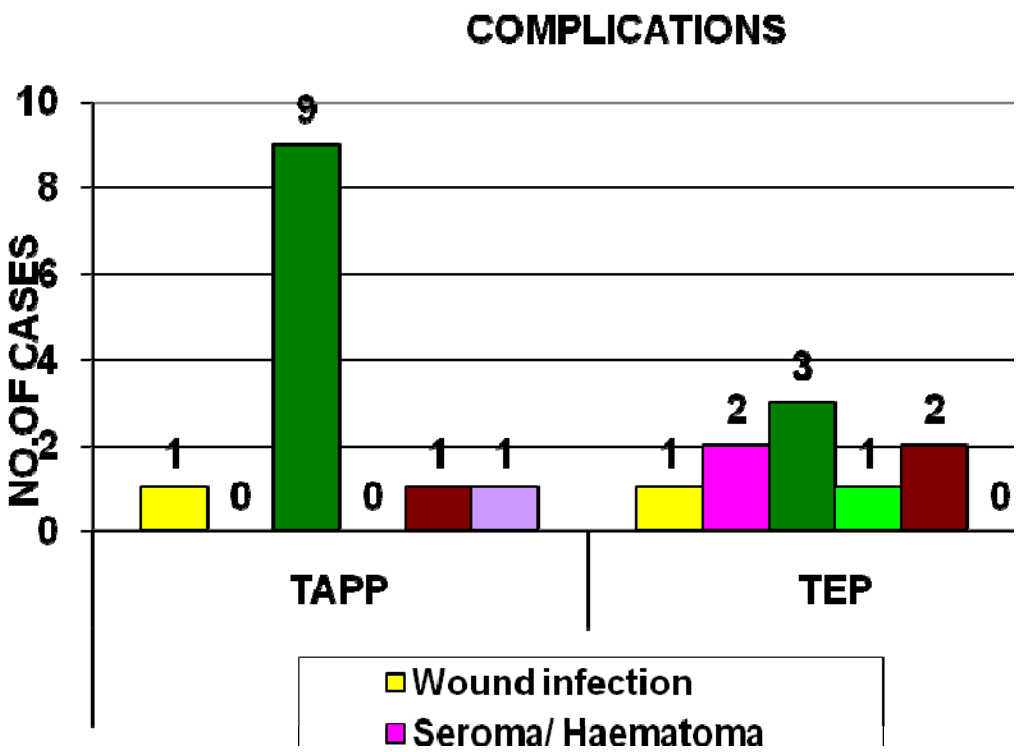

COMPLICATIONS
NO. OF CASES
10
8
6
4
2
0
9
1
0
0
1
1
1
2
3
1
2
0
TAPP
TEP
Wound infection
Seroma/ Haematoma

Table – 4

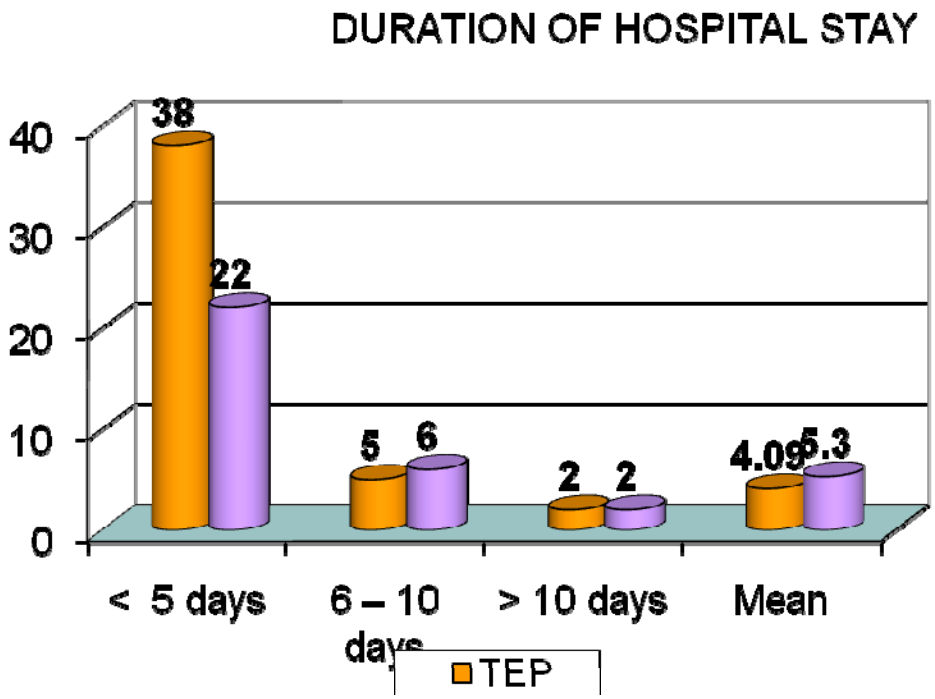
Complications

Complications %	**Pain**	**Wound Infection**	**Conversion**
TEP (n=45)	6.66 %	2.2%	4.4%
TAPP (n=30)	30 %	3.3%	3.3%
'p' value	**0.048** **Significant**	**1.000** **Not Significant**	**1.000** **Not Significant**

Table - 5

Duration of Hospital Stay

Duration in days	**TEP**	**TAPP**
≤ 5 days	38	22
6 – 10 days	5	6
> 10 days	2	2
Mean	4.09	5.3
S.D.	2.79	3.53


DURATION OF HOSPITAL STAY
40
30
20
10
0
38
22
5
6
2
2
4.09
5.3
< 5 days
6 – 10 days
> 10 days
Mean
TEP

DISCUSSION

Age

In our patients age ranged from 18 to 80 years. More than 75 percent over 31 years. The maximum incidence was in the age group of 31-50 years (50.66%).

Type of Hernia :

In 75 cases studied 46 cases were of indirect inguinal hernias (61.33%). 25 cases were direct inguinal hernias (31.33) and 4 were bilateral hernia (5.33%).

Indirect inguinal hernias were more common

Post-operative complications:

Post operative pain in patients undergoing TAPP (30%) was found to be more than patients undergoing TEP. (6.6%) which was statistically significant. P value is 0.048.

The post operative wound infection in TAPP group was 3.3% when compared to TEP group which was 2.2%. P value is 1.000 which was not statistically significant.

Conversion Rate in patients undergoing TAPP was found to be 3.3% when compared to undergoing TEP which was 4.4%. P value is 1.000 which was not statistically significant.

There was a recurrence in one case in TEP group at 1 month followup.

There was one case which had a bowel injury (Serious adverse events) in TAPP group which was repaired.

The mean duration of post operative hospital stay in TEP group was 4.09 days when compared to TAPP which was 5.3 days.

In our study TAPP patients had higher post operative pain and had a longer postoperative hospital stay when compared to TEP patients.

Laparoscopic Inguinal Hernia Repair (LIHR) has got comparable results in comparison to tension free open hernia repair (OHR). Many studies have shown that LIHR gives similar results in terms of recurrence as compared with OHR but with the added advantage of less chances of post operative, pain, wound infection and early return to activity

In a study by Arvidasson D et al8 compared 5 years recurrence rates of laparoscopic inguinal hernia repair Vs. Shouldice repair of primary inguinal hernia which is considered the gold standard for open non-mesh repair of hernia. The cumulative recurrence rate after 5 years was 6.6% in the TAPP group and 6.7% in the Shouldice group

Wara et al9 have demonstrated that laparoscopic repair compared favourably with Lichteinstein repair for primary indirect and direct hernias, unilateral and bilateral hernias, and recurrent hernias but was

inferior for primary bilateral hernias.

There have been 4 non randomized comparative studies that have compared the 2 techniques i.e. TAPP vs TEP (4,10,-12). The results of these comparative trials have shown that the 2 techniques are comparable with regard to the complications such as vascular and visceral injury. However, the port site recurrence was shown to be higher in the TAPP compared with TEP technique. The operating time and the cost of the procedure were not compared in any of the trials.

In a comparative trial of 491 consecutive herniorraphies by Kald et al12, TAPP was compared with TEP. Hernia recurrence was shown to be higher in the TAPP group (7/339 vs 0/87) after a mean follow up of 23(9) and 7(4) months respectively. Other complications were similar with both the techniques. However, serious intraabdominal complications occurred in the TAPP group patients with bowel obstruction and one with severe neuralgia. These complications were not seen with a completely preperitoneal TEP approach. Although the TEP method is technically more difficult, the mean operative time in TAPP (339 patients) and TEP (87 patients) groups were similar {80(32) minutes vs 80 (41) minutes; $p = 0.9$}. The mean hospital stay and the times to full recovery were also similar in the TAPP and TEP groups.

There is only one randomized controlled trial comparing TAPP with TEP repair13. In this RCT, 52 patients were randomized to either TAPP or TEP. The study showed that the 2 techniques were similar with regard to the complications, time to return to activities and hernia recurrence. However, the length of stay was shorter in the TAPP group (3.7 vs 4.4 days; p=0.03).

However, since there is only one RCT involving only 52 patients, the Cochrane database review 2005 has concluded that there are insufficient data comparing TAPP and TEP techniques of laparoscopic inguinal hernia repair.

CONCLUSION

Totally Extraperitoneal Repair (TEP) is preferred over Transabdominal Preperitoneal Repair (TAPP) for laparoscopic hernia repair because it preserves the peritoneal integrity and also has lesser post operative pain. However, TEP repair has been associated with a steep learning curve. It's a technically demanding procedure because of the unfamiliar anatomy and requires lot of training and laparoscopic experience. A gradual shift towards TEP has been observed worldwide because of is advantages such as reduced risk of bowel injury, bowel adhesions and incisional hernia formation. Still TAPP repair holds good for huge hernia and in initial learning phase.

LIMITATIONS OF THE STUDY

1. The sample size selected should be more.
2. Follow up of patients after 1 month was difficult due to poor compliance of the patients.
3. TEP has a long learning curve hence complications tend to occur in initial period.

BIBLIOGRAPHY

1. Skandalakis E., Surgical anatomy and embryology Surgical clinics – North America. Vol. 80.
2. Art of Laparoscopic surgery- Dr.Palanivelu, 1st Edition, Page 1169- 1187.
3. Mastery of Surgery - Joseph E. Fischer, 5th edition.
4. Richard S Snell. Clinical anatomy, 7th edition, p 155 - 184.
5. Surgical laparoscopy – Karl.A.zucker, 2nd Edition.
6. Abdominal wall Hernias Principles and management- Robert Ben David, 3rd Edition.
7. Maestry of Endoscopic and Laparoscopic surgery- Nathaniel J. Soper, Lee L. Swanström, W. Stephen Eubanks, 3rd Edition, Page 523.
8. Nyhus and Condons' Hernia- Robert J. Fitzgibbons, A. Gerson Greenburg, Lloyd Milton Nyhus, 5th Edition.

PROFORMA

Name : IP No. :

Age / Sex : Occupation :

Address :

Date of admission : Date of Surgery:

Date of Discharge:

Diagnosis :

Surgical technique :

Duration of operation (min):

Post operative complications :

	YES	**NO**
1. Serious adverse events (including visceral injuries and vascular injuries)		
2. Pain		
3. Conversion		
4. Haematoma		
5. Seroma		
6. Wound/Superficial Infection		
7. Mesh/Deep Infection		
8. Persisting numbness 9. Recurrence		

MASTER CHART

TRANSABDOMINAL PREPERITONEAL REPAIR

Name	IPNo.	Age in yrs	Sex	PAIN	Seroma / hematoma	Wound Infection	Conversion	Serious adverse event	Recurrence	Duration of Hospital stay	Type of Hernia
Nageshwaran	93419	49	M							4	ID
Latchmanan	687682	24	M							4	D
Raju	58902	50	M							4	ID
Murugan	85107	45	M	√						6	D
Gajini Mohammed	34204	39	M							4	ID
Joseph	26462	48	M	√						6	ID
Kannan	98909	24	M				√	√		22	ID
Sethu	15696	28	M							3	ID
Murugan	65451	40	M							3	ID
Karuppaiah	6935	25	M							4	D
Murugesan	103629	55	M	√						7	D
Balasubramani	98921	26	M							4	ID
Palanisamy	41313	46	M	√						11	ID
Malaisamy	34832	54	M							3	ID
Gurunathan	78638	42	M							5	ID
Poochendu	80178	35	M	√						5	ID
Vellai	83969	55	M	√						6	ID
Rajendran	88653	24	M							4	ID
Kannan	98907	44	M	√						5	ID
Sethu	10696	25	M							4	D
Santhanakumar	21576	20	M			√				4	D
Karuppasamy	26207	20	M	√						7	ID
Palani	62564	26	M							4	ID
Mani	57080	40	M							4	D
Mohan	73591	40	M							4	D
Rehan	31961	31	M							4	ID
Sakthivel	42648	28	M							4	D
Selvam	44367	19	M							4	ID
Gopal	44368	37	M	√						6	ID
Mariyadoss	31092	30	M							4	ID

TOTALLY EXTRAPERITONEAL REPAIR

S.No.	Name	IPNo.	Age in yrs	Sex	PAIN	Seroma / hematoma	Wound Infection	Conversion	Serious adverse event	Recurrence	Duration of Hospital stay	Type of Hernia
1	Kamaraj	73241	18	M							5	D
2	Adhiya manitam	453219	60	M				√			3	D
3	Adaikkan	467892	64	M							11	ID
4	Rengaraj	457895	25	M							4	D
5	Paramasivam	74523	45	M							3	ID
6	Sathyamoorthy	453296	38	M							2	D
7	Madhavan	76894	55	M	√	√					7	D
8	Subramani	455543	47	M							4	ID
9	Murugan	487653	37	M							3	D
10	Tajamoideen	459087	42	M							2	ID
11	Kanifa	439998	45	M			√	√			18	B/L D
12	Kalmajan	75569	22	M							4	ID
13	Perumal	76142	67	M							3	D
14	Krishnan	488976	51	M							4	D
15	Anbu	76987	56	M							3	ID
16	Arumugam	423678	38	M	√						6	D
17	Mariappan	459986	57	M							3	ID
18	Marikani	75643	43	M							2	D
19	Arumugam	487623	45	M							3	ID
20	Sokkan	458762	57	M							4	D
21	Krishnaswamy	498712	28	M							3	ID
22	Subramani	490078	50	M							3	ID
23	Alagupandi	500987	45	M							2	ID
24	Mokkaiah	489712	55	M							4	ID
25	Selvaraj	504560	51	M							4	ID
26	Ramar pandi	499821	24	M							3	ID
27	Kumar	465699	30	M							2	D
28	Ochathevan	500372	52	M							3	D
29	Devaraj	490871	55	M							4	ID
30	Perumal	76984	61	M						√	7	B/L D
31	Ramakrishnapandian	487612	32	M							3	D
32	Devaraj	78612	55	M							3	ID
33	Perumal	76511	61	M							4	ID
34	Pooncholai	481943	43	F							4	ID
35	Akbar Ali	499210	34	M							4	D
36	Mani	510264	45	M	√						7	B/L D
37	Selvam	75432	40	M							3	D
38	Pushpam	500231	42	M							2	ID
39	Andi	76109	40	M							3	ID

40	Thavamani	70908	55	F							4	ID
41	Jeyaraj	71254	40	M							2	ID
42	Periyakaruppan	481258	70	M							3	ID
43	Palpandi	78365	35	M		√					8	B/L D
44	Jehan	51285	32	M							3	ID
45	Abdul Azeez	79358	32	M							2	D